

CACTACEAE

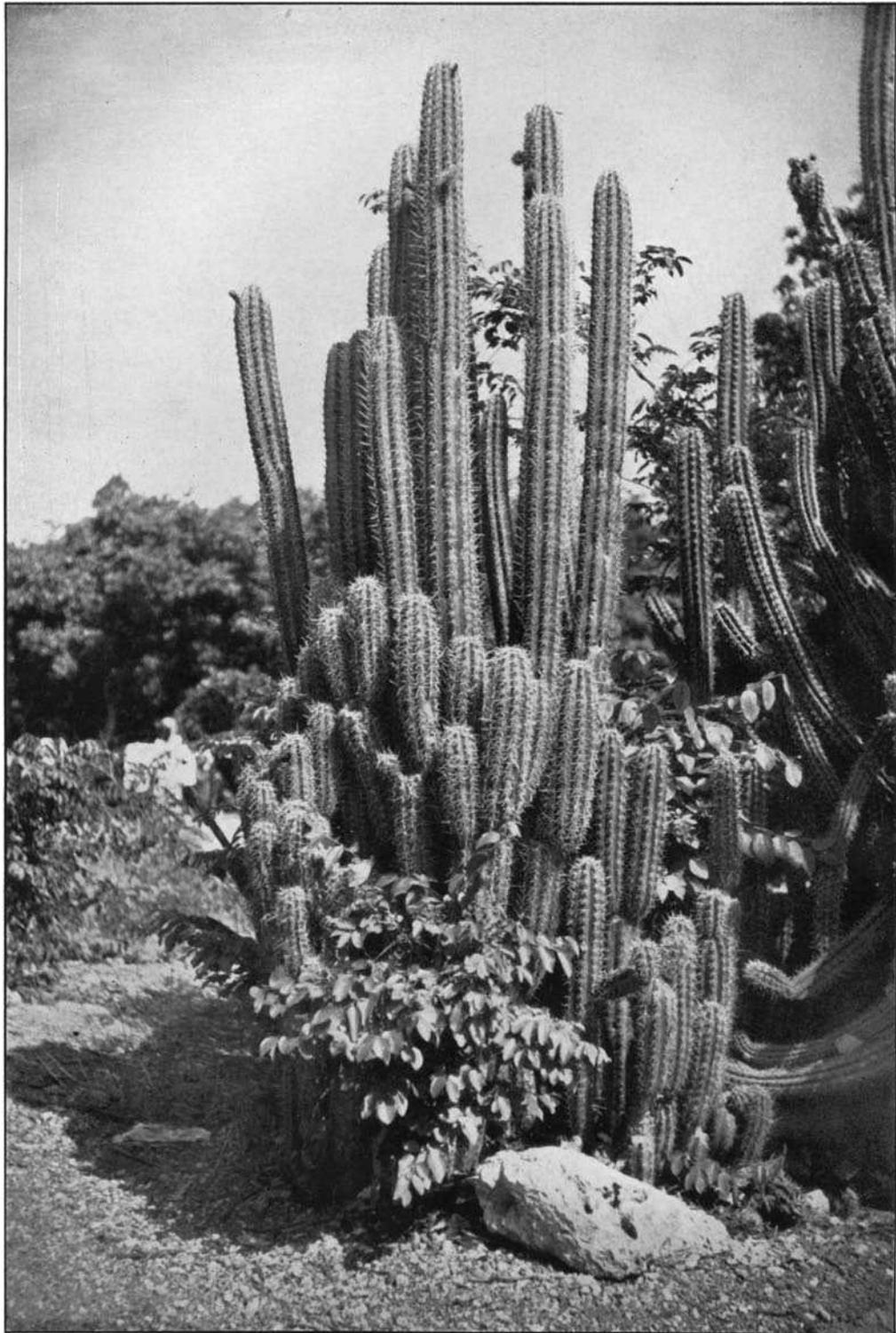


FIG. 1. *Lemaireocereus griseus* (Haw.) Br. & R. x 0.04. Habitat photo from Curaçao, Dutch West Indies, by F. W. Arnoldo.

CACTACEAE

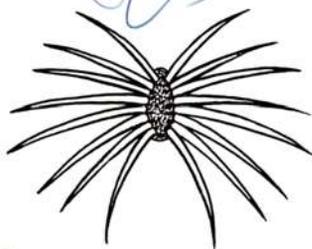
WITH ILLUSTRATED KEYS OF ALL TRIBES, SUB-TRIBES
AND GENERA

W. Taylor Marshall *and* Thor Methven Bock

Arranged and Published by Scott E. Haselton

SUPPLEMENTING THE WORK OF
DOCTORS BRITTON AND ROSE,
THIS VOLUME DESCRIBES ALL OF
THE ACCEPTABLE NEW GENERA
AND SPECIES SINCE NINETEEN-
NINETEEN AND THE CHANGES IN
CLASSIFICATIONS NECESSITATED
BY RECENT DISCOVERIES

W. Taylor Marshall



Thor Methven Bock

ABBAY GARDEN PRESS, PASADENA, U.S.A.

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PUBLISHING BY SCOTT E. HASELTON

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Dedicated to

MY DAUGHTER, AGNES,
WHO FIRST BROUGHT TO
MY ATTENTION THIS
MOST INTERESTING
PLANT FAMILY

W. TAYLOR MARSHALL



Dedicated to

MR. JACQUE J. PIERRE
THOR METHVEN BOCK

Add to page 204 "Cactaceae"—Marshall and Bock

Page 12: Substitute Sub-tribe for Sub-genus before each of the 8 terminations of the key.

Page 26: Under "Illustrated in Plate 11," changes figures 3, 4, and 5 to read 4, 5, and 6. List *Rebutia minuscula* as Fig. 3.

Page 130: Genus 7 should read Genus 6

Page 192: The flowers of *Chiapasia* are rose-pink instead of white.

Page 207: Second and third lines of heading, and brackets so that the statement reads: "Subdivisions of the family lower than tribes, (sub-tribes, sections and sub-genera) are in Roman capitals."

Page 219: *Morawitzia* should be *Morawetzia*.

A card index has been compiled of all owners of "Cactacea" (Marshall and Bock) to whom a news letter will be sent from time to time. This bulletin will list new species and changes in nomenclature so that this volume will be kept up-to-date. Please mail any comments, questions, or suggestions that may help in this work. If you do not have the foundation books "The Cactaceae" (Britton and Rose) address Box 101, Pasadena, California.

Foreword

THE AUTHORS of "Cactaceae" are well qualified for this long-needed book. Both have grown cacti as a hobby for many years and the results of their experience is ably set forth in text and drawings.

The senior author, W. Taylor Marshall, has studied these plants for twenty years and has visited most of the habit localities of the cacti growing in the United States. He has been on expeditions in Lower California, the mainland of Mexico, and the West Indies. Most of the cactus world is familiar with his articles in the "Cactus and Succulent Journal of America," his "Contributions to a Better Understanding of Xerophytic Plants," and the "Illustrated Glossary of Succulent Plant Terms." He has written the text in a very understandable style.

For four years Mr. Marshall has been president of the Cactus and Succulent Society of America, Inc., and received an honorary fellowship in the Society for his valuable services. He has shared his knowledge with all cactus growers and through his generosity there are thousands of plants in collections all over the world.

The one hundred and forty-six drawings of the genera in this book were executed with a fine brush by Thor Methven Bock who spent over a year in perfecting them. Not only are they botanically accurate but each plate is a picture in itself; we are fortunate in having the artist an actual student and grower of cacti. Mr. Bock has illustrated other books and articles with his drawings of succulents and has made many large studies in color.

The excellence of Mr. Bock's technique is readily understood after tracing his inherited ability from a family of noted artists and the training in the best schools in the country. Specializing in portrait and landscape painting seems to have lessened in no degree his enjoyment in drawing cacti.

We are proud of the hundred and fifty new photographs which were contributed by collectors and students from all parts of the world. It is inspiring to see photographs by growers from Maine to Indiana, which is masterly proof

that cacti can be flowered in temperate zones as well as in California or Florida. The habit pictures are unusual and will take the readers visually to the varied habitats of these interesting plants. We have endeavored to credit those who have opened their gardens to us and we know of hundreds of others who had equally as interesting material which should have been photographed.

The "Cactaceae" with its illustrated genera, its recent species since Britton and Rose's monograph, its new species described herein for the first time, the understandable comparisons of genera, and the check list of all species, is sure to be of inestimable value to collector, grower and student. The authors are to be congratulated for their generous contribution to the literature of cacti.

SCOTT E. HASELTON, *Editor*,
Cactus and Succulent Journal of America.

Introduction

SINCE 1929 THERE HAVE BEEN OUTSTANDING TAXONOMIC OR CULTURAL BOOKS ON CACTUS produced by seven writers, six of whom have used the system of classification proposed by Britton and Rose.

Houghton in "The Cactus Book" 1930, Vera Higgins in "The Study of Cacti" 1933, Hosseus in "Notas Sobre Cactáceas Argentinas" 1939, Helia Bravo in "Las Cactaceas de Mexico" 1937, Borg in "Cacti" 1937, and Haselton in "Cacti for the Amateur" 1938, all used the Rosean system. Only Backeberg, in "Kaktus ABC" published in Danish in collaboration with Count F. M. Knuth in 1935, and in his "Blätter für Kakteenforschung," a magazine published in Germany over a period of three years, attempted an extension of the Rosean system.

Backeberg based his system on the supposition that the equator formed a definite barrier and that no genus could extend both north and south of this imaginary line. In "Kaktus ABC" he lists 141 genera, or 17 more than did Britton and Rose; but by 1938, 37 more genera were necessitated by this very artificial division. In all, he listed 178 genera.

Of the first 141 genera, Borg said: "(The system)—has many points in its favor, but it offers much scope for controversy, and will very likely have to be considerably modified before general acceptance." Borg found acceptable the new genera *Aztekium*, *Encephalocarpus*, *Neowerdermannia*, *Notocactus*, *Obregonia*, *Parodia* to replace *Hickenia*, *Porfria*, *Pyrrhocactus*, *Spegazzinia* (Weingartia), and *Stenocactus* to replace *Echinofossulocactus*. We concur in these conclusions.

He rejected the genera *Consolea*, *Eriocereus*, *Maihueniopsis*, and *Pilocereus*. We believe these genera are founded on sound reasoning and we accept them. We are in accord with him in rejecting *Aylosteria*, *Brasillopuntia*, *Corynopuntia*, *Cylindropuntia*, *Friesia*, *Haageocereus*, *Islaya*, *Morawetzia*, *Platyopuntia*, *Pseudoespostoa*, *Rhodocactus*, and *Tephrocactus* as being unworthy of generic rank.

Borg's book is the nearest answer to our long-felt need for a popular book on the family, but it is incomplete in that only those species with which he was personally familiar are there described. Therefore there is still a need for a popular book in non-technical language which will list all of the known species and provide a short description of species located since the publication of the Britton and Rose monograph, give cultural directions and explain the new genera that are acceptable, with reasons for their acceptance as well as the reasons that make other new genera not acceptable. This book is designed as an attempt to fill this need.

To further clarify our explanations of the genera, we include twenty-six plates of brush and ink drawings opposite the keys, and six plates of forms and technical terms. There is also a photographic illustration of a typical plant of almost every genus.

We gratefully acknowledge receipt of plant material for study from the following: R. W. Kelly of Temple City; Dr. R. W. Poindexter of Compton; Mrs. Neff Bakkers of San, Diego; J. Whitman Evans of Phoenix, Arizona; Ferdinand Schmoll of Cadereyta, Mexico; Roberto A. Mora of Concepción, Chile; Dr. H. V. Halladay of Las Cruces, New Mexico; Mrs. Eunice Bullington of Deming, New Mexico; Dr. C. H. Boissevain of Colorado Springs, Colorado; J. Frank Parks of Dallas, Texas; Harry Johnson of Hynes, California; Gilbert Tegelberg of Inglewood, California; Mrs. Emma J. De G. Lanier of Habana, Cuba; Frank Mark of Los Angeles, California; and H. O. Bullard of Hackensack, New Jersey.

Valuable field notes have been received from: Dr. Elzada U. Clover of the Botany Department at the University of Michigan; Graham Heid; Dr. R. W. Poindexter; and H. O. Bullard.

Photographs used in illustrating the text have been acknowledged in each instance and we thank our many friends who have so kindly helped in this work.

W. TAYLOR MARSHALL, F.C.S.S.

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C A C T A C E A E

THE CACTACEAE

Among Nature's wonders in the vegetable kingdom there are few groups of plants which attract as much attention as the cacti. Although many are grotesque in form, they bear flowers of rare beauty. Cacti are heavily armed for protection and shade, yet the armor which is intended to repel, serves as an additional attraction with its intricate spine system and coloring.

The family CACTACEAE is of recent origin as plant families go, being possibly as young as ten thousand years. It occupies desert and semi arid regions, not from choice, but, as geological changes produced aridity, this family showed a greater adaptability to the changing conditions than did members of other plant families within the same range.

There is much evidence to prove that the more primitive cacti had a common ancestor with the roses and myrtles. Several cacti, described in Tribe 1, still survive as trees or bushes with almost normal leaves and with flowers superficially resembling those of the wild rose (see Pl. 1: Fig. 4)

In Tribe 11, other forms show the gradual thickening of leaves which at first are flat (as in *Pereskia* Pl. 3: Fig. 1), but later take an awl shape (Pl. 2: Fig. 6). At first they are persistent, but in later forms they appear only on the young, growth, from which they fall in a few weeks. In Tribe 111, leaves are completely absent on the vegetative parts and are seen only as cotyledons (Fig. 2).

In the process of evolution, as the supply of water from rainfall became less, members of the family CACTACEAE altered their forms to become more drought resistant, until in extreme forms, well exemplified in *Ferocactus* (Pl. 15: Fig. 22), very little water is lost in evaporation and the plants are well equipped to withstand a period of several years without any rainfall.

There is a noticeable thickening of the cutin (or outer skin) in cactaceous plants, and the pores of the, cutin are fewer in number than in other plants. The pores are also depressed below the surface of the cutin to form a cushion of dead air to slow up evaporation. In many species there is a heavy wax coating on the cutin, while in some species it is so heavy as to give the appearance of a white dust on the plant (as on *Lemaireocereus Beneckei*). This wax is further supplemented by hairs or tomentum, all to conserve moisture (as in *Opuntia tomentosa*).

The family CACTACEAE is native to the Americas only, and was unknown prior to the discovery of America by Columbus. Three or four species of the genus *Rhipsalis*, an epiphytic pendant plant, are found in Africa, Madagascar, and adjacent islands, possibly carried by migratory birds from their native America. In the Mediterranean region, several species of *Opuntia* have become extensively naturalized from cuttings brought from America by early explorers, and in Australia and South Africa they have become a pest covering millions of acres since their introduction as possible forage for cattle.

Mexico is the country richest in cacti, and more genera and species are indigenous to Mexico than to any other country. The states of Texas, New Mexico, Arizona, Nevada and California have many species of cacti, but a few species are found in almost every state in the Union.

A few species are found in arid or partly arid sections of Central America and the West Indies. Brazil, Argentina, Chile, Bolivia and Ecuador are also rich in the number of genera and species represented. All of the South American republics have a representation of species, and it may be stated that cacti are found from as far south as Patagonia to the Arctic Circle.

ORGANOGRAPHY

All cacti are dicotyledons; that is, the plant on germination sends up two or more seed leaves (Fig. 2), called cotyledons. Being dicotyledons, there is a cambium layer (Pl. C: Fig. C) completely surrounding the vascular bundles (Pl. C: Fig. D). This cambium, or generative zone, permits the stem to increase in diameter and makes grafting possible.

They are also phanerogams, or plants producing a visible flower, and all of the species are perennial.

Cacti may be trees, shrubs or herbs with more or less fleshy stems which are usually jointed. Leaves are rarely present and when present are usually rudimentary. Chlorophyll, the green coloring matter of the leaves, is, in this family, generally found in the green stems, and the functions of photosynthesis, the process whereby the sugars are changed to energy producing starches, is carried on in the stems.

The buds are usually geminate (twin) within an areole, the lower bud developing the spines and the upper bud producing branches or flowers (Pl. 8: Fig. 35). In the one sub tribe CORYPHANTHANA, the buds are separated, the lower bud is in an areole on the tip of a wart like projection, called a tubercle, producing spines only, or in very rare cases also producing branches; the upper bud is located in an areole at the axil of the tubercles or at the base of a groove on the upper part of the tubercle (Pl. 22: Fig. 13). This upper bud may be naked or it may be furnished with hairs or bristles, and from it the flowers arise.

The flowers are usually regular, (Pl. F), but in a few genera they are irregular, or zygomorphic (Pl. 23: Fig. 1). They usually have both stamens and pistil in one flower (Pl. F), but some instances of dioecious flowers are recorded. They are generally solitary, but sometimes clustered, and in some instances produced in a specialized dense inflorescence, either lateral or terminal, called a cephalium (Pl. 19: Fig. 2).

The perianth is multiple, the calyx is often indistinguishable from the petals, which are in two or more whorls, distinct or forming a tube. Stamens are usually numerous, and the anthers are two-celled (Pl. F). The ovary is inferior (below the petals and stamens), one-celled, and usually with parietal placentas (Pl. 2: Fig. 4), the simple style having as many lobes as there are placentas.

The fruit is usually a one celled berry, without divisions between the seeds, but in one genus only, *Pterocactus*, it is a dry capsule.

Many types of roots are represented in the family, but most species have fibrous roots; carrot-like roots are observed in many species, however, and a dahlia like tuber is found in several genera (*Wilcoxia* and *Peniocereus*, Pl. 6).

The stem is not very fleshy in the first forms, but in *Opuntia*, especially the *Platyopuntias* with flattened, oval stems (commonly called «pads»), it is very fleshy. The stems of the EPIPHYLLANA sub tribe (Pl. 24) are much flattened and leaf like, with areoles only on the margins. This form is common also in the sub tribe RHIPSALIDANA (Pl. 25), and rounded» pencil-like stems are also noted here. In the sub tribe HYLOCEREANA (Pl. 10), the stems are mostly three-winged and jointed. All of these last three sub tribes have air roots with a thin, absorbent covering (called velamin) on the stems; these roots serve the double purpose of support by clinging to the host tree, and of absorbing food found in the crotches of the trees and water from the tropical rains common in the districts they inhabit.

In the remaining sub tribes the plants are either columnar, with stems provided with accordion like ribs (Pl. C); or globose, in which case they may be ribbed, or covered with wart like tubercles. These ribs or tubercles permit an accordion like expansion of the stem in wet periods and a corresponding gradual shrinking during dry periods.

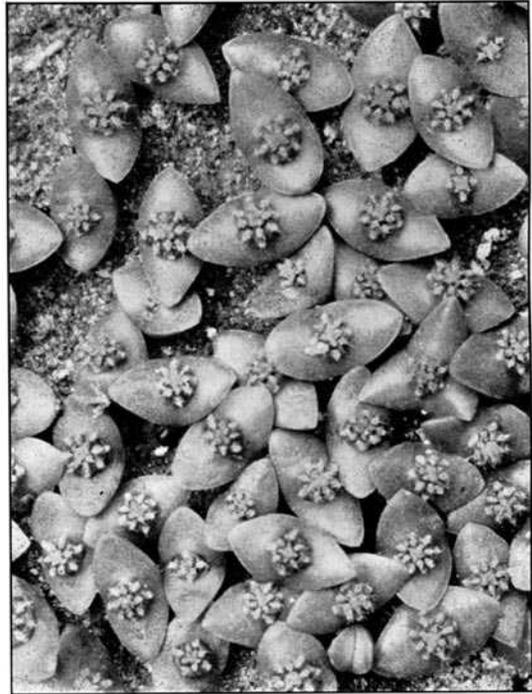


Fig. 2. Cactus seedlings showing the seed leaves x 1.
Photo by Wright Pierce.

Spines are of many types, ranging from the strong, subulate armament of *Ferocactus rectispinus* with spines eight inches long in some plants, to the feather like processes found on *Mammillaria plumosa*. They may be straight or hooked, rounded, flattened, or ribbed. In *Opuntia glomerata* and *Toumeyia papyracantha*, they are flattened and paper like, while in many species of *Cephalocereus* and *Pilocereus* they are reduced to silken hairs. Examples of various spine types may be seen in Plate D.

The few species of cacti first found by the early explorers were called, "cactus" from the Greek "kaktus" meaning "thistle," because of their fancied resemblance. It was at first thought that but few species existed, and all the plants first discovered were so called, but later explorers found so many more species that a more extensive classification became necessary. Several systems of naming were proposed before a satisfactory system was devised by the botanist, Karl Schumann, in 1898.

So many additional species were discovered after Schumann's time that his system became obsolete, and in 1904, Dr. N. L. Britton and Dr. J. N. Rose, under the auspices of The Carnegie Institution, of Washington, began a study of the CACTACEAE. As a result of their work, a monograph on the family was published in four volumes, the first of which appeared in 1919, followed by the other three volumes in 1920, 1922, and 1923, respectively. A reprint of this valuable monograph was published by the Cactus and Succulent Society of America, in Pasadena, California. Without a doubt, the American interest in these plants today is due to the influence of these two pioneers who first made available in English a complete work on the cacti.

For greater convenience, Britton and Rose divided the family into three tribes and eight sub tribes, with 124 genera and 1235 species. The following classification is based on "The Cactaceae" of Britton and Rose, with a few revisions necessitated by later investigation, and the new species recently discovered. Credit for many of these revisions is given to Curt Backeberg of Hamburg, Germany, as noted in his "Blätter für Kakteenforschung." Herr Backeberg's explorations in South America have given him a remarkable insight into the plants of that district.

Our basic standard for classification in America and many other countries is the system of Britton and Rose. We have, therefore, retained their classification except where new discoveries have made readjustment advisable.

The three tribes of cactus are: PERESKIEAE, OPUNTIEAE, and CEREEAE.

Tribe I. PERESKIEAE

The members of this tribe are woody trees, bushes, vines, or low, matted ground cover. The arborescent species somewhat resemble a rose, but differ in the substitution of spines for the familiar rose thorns. The spines, branches, and deciduous or permanent leaves, arise from the areoles (spine cushions). There is a complete absence of the barbed bristles, called glochids, and this constitutes the major difference between the PERESKIEAE and the Glochid bearing OPUNTIEAE.

Tribe II. OPUNTIEAE

The second tribe is characterized by the presence of glochids (Pl. D: Fig. 10), or easily detached barbed bristles, which fill the areoles at the base of the spines, if any spines are present. In OPUNTIEAE, the leaves (Pl. 1: Fig. 7) which are inconspicuous or absent on most genera, are, when present, thick, succulent, either flat or more commonly awl shaped, and fall away very early. Leaves must not be confused with the stems or branches (see Fig. pg. 61) which form the main part of the plant. The branches are usually fleshy, much jointed, and mostly spine bearing. Flowers are usually rotate or wheel shaped, are without stems (pedicels).

Tribe III. CEREEAE

Members of this, the largest tribe, are usually leafless except for the cotyledonary leaves on young seedlings. There are no glochids in the areoles. The flowers are attached directly to the plant (are said to be sessile or without stem), usually singly from the upper part of the old areole. As the tribe CEREEAE has more than 120 genera, it is again divided into 8 sub tribes, as follows:

Sub tribe 1. CEREANAE (Pl. 5, 6, 7, and 8) is usually tree or bush like with numerous branches ribbed so as to appear scalloped (Pl. C: Fig. 10) in cross sections. The funnel shaped, cylindrical or bell shaped flowers grow from the same areoles as do the spines (Pl., 5: Fig. 1), usually from near the top, but on the sides of the stems. In seedlings, the areoles are borne on distinct tubercles which later grow to form ribs. All members of this sub tribe are terrestrial, that is, growing on the ground, and do not produce air roots.

Sub tribe 2. HYLOCEREANAE (Pl. 9 and 10) is a group of vine like cacti producing aerial roots (Pl. 10: Fig. 1) by which they cling to trees and rocks, frequently severing all ground connections and living on trees as epiphytes, but not as parasites. The flowers are usually very large. This group has a tendency to decrease the number of ribs and is frequently 3 winged, or ribbed. With the exception of *Aporocactus* (Rat tail Cactus), and *Deamia*, all species flower at night, and are said to be nocturnal.

Sub tribe 3. ECHINOCEREANAE (Pl. 11). These plants are usually low, stems either single or in clusters, mostly one jointed and heavily ribbed. The spines, if any, arise from the spine cushions on the ribs. The showy flowers arise from the same areoles usually on the sides of the stem and are funnel shaped or bell shaped. The fruit is either smooth or spiny and, with few exceptions, fleshy. It either retains the seed after ripening, or drops the seed through a split in the side of the fruit.

Sub tribe 4. ECHINOCACTANAE (Pl. 12, 13, 14, 15, 16, 17, and 18) is intermediate between, Sub tribe 3 and Sub tribe 6. The plants are usually low and small, but in a few instances are very large. Usually the stem consists of one joint only, which may later branch at the base, forming clusters of one jointed stems. The stems are usually ribbed and bear spines from the spine cushions on the ribs. The highly developed flowers arise from near the tops of the plants and there is rarely more than one flower produced from one areole. The fruit is sometimes smooth, but usually has leaf like scales and usually lacks pulp; the seeds escape from a pore in the base of the fruit where it breaks away from the plant when ripened.

Members of this sub tribe are distinguished from the ECHINOCEREANAE by the more nearly central position of the flowers, and from the CORYPHANTHANAE, in which flowers are produced from areoles other than the spine bearing ones.

The pore through which the seeds escape from the fruit of most of the genera of this sub tribe will not be noticed if the fruit is gathered before it ripens, but as the fruit ripens, the lower part, which is attached to the plant, is gradually absorbed and when the fruit, fully ripened, falls off the plant, this pore is observed as a large opening, sometimes an inch in diameter. The seeds are attached to the inner surface of the walls of the pulp-less fruit and as they ripen they fall to the bottom and escape through the pore. In *Mila* and a few other genera of this sub tribe, the fruit is a juicy berry.

Sub tribe 5. CACTANAE (Pl. 19) contains but two genera, members of which are easily distinguished from all members of the family by the peculiar head like structure from which both flowers and fruit arise. This cephalium, or head, consists of a woody core surrounded by dense masses of long wool, or bristles, or both. The cephalium appears to be growing out of the top of the globose plant. It is often long and always prominent, and constitutes a ready method of identifying the plants.

Sub tribe 6. CORYPHANTHANAE (Pl. 20, 21, and 22). Although the stems of the plants of this sub tribe are one jointed, the globe shaped or somewhat cylinder shaped, relatively small stems frequently form large clusters. The stems are not usually ribbed, but are provided with tubercles or nipple like projections which may be arranged in rows, usually spiralled, and sometimes superficially resemble ribs.

The flowers may come from the side, or the top of the plant, but never more than one from an areole and never from spine bearing areoles. They are large in some genera and small in others. One genus, *Cochemia* (PL 21: Fig. 6), has a long, tubular flower whose sepals are colored like

the petals and are placed as a second ring on the oblique tube, but in all other genera the flowers are regular.

The fruit is a red or green berry, either naked or with a few scales, and is usually juicy. In only two genera, *Echinomastus* and *Thelocactus*, the fruit is dry and drops the seed through an opening in the base of the fruit.

Sub tribe 7. EPIPHYLLANAE (Pl. 23, and 24) is tropical, mostly epiphytic on trees, but sometimes found in rock crevices rich in humus. The branches are flat and leaf like, and usually without spines. The flowers are large and showy, mostly night bloomers and in two genera they are irregular (Pl. 23: Fig. 1 and 2)

Sub tribe 8. RHIPSALIDANAE (Pl. 2 5). The stems of these epiphytic plants are cylindric and pencil like to flat and leaf-like. They are native to the tropical forests where rainfall is plentiful; there they form huge masses in the host tree with pendant stems sometimes to 30 feet long.

The flowers are very small, white to pinkish in color, and are followed by purple or white berries resembling gooseberries. The novice in cacti has difficulty in reconciling these mistletoe like plants with his preconceived idea of the family.

IDENTIFICATION OF GENERA

The greatest need of the amateur is a readable description of all of the genera of cacti, explaining how one differs from another. Monographs containing thousands of pages have been written and each new cactus book contains long, meaningless lists that usually lead to confusion.

Most listings of cacti are arranged according to their believed evolutionary development. In this manner, related genera fall near each other where comparisons are easier.

In a garden, similar varieties should be grouped together, where their culture may be varied according to their needs. There is a danger of over caring for cacti, since it is true that they will stand more neglect than other cultivated plants. Cacti will thrive and flower if properly planted in well-drained, loose soil with the proper exposure and occasional attention. A knowledge of the climates of the various habitats will be helpful in determining the growing season.

Classification of cacti is based principally upon the floral characteristics, since the vegetative or plant forms are more liable to change than the flowers. There is no positive, unbroken chain in plant evolution, and many times two seemingly closely related species have developed independently yet along parallel lines, finally, resulting in a striking resemblance. Plants take on similar characteristics as they adapt themselves to environment. Therefore any evolutionary arrangement is more or less arbitrary and is made for convenient study and classification. The cactus family is, relatively, of recent origin, and has been thought to be but a few thousand years old. Recently discovered fossils, thought to be *Opuntias*, may necessitate a revision if the fossils prove to be cacti.

The following generic descriptions have been simplified to show the chief differences between them, and they can be quickly learned by any amateur who desires to know why one genus differs from another.

This text includes nearly all the known species, but with the changing of names and the finding of new species, there is never a constant number. The same plant may be called many different names until such time as a name becomes known and accepted by a majority of botanists; then these discarded names become synonyms. Where there is still some confusion in the name of a genus, its recent synonyms have been included in this book directly under each heading. These synonyms will help the beginner to classify a plant when he finds it mentioned by one of the other, incorrect names.

Short descriptions of species published since Britton and Rose wrote their «Cactaceae» are included herein, and these, with the species listed in the "Cactaceae," comprise all species known to me at this time.

Having now considered the division of the family CACTACEAE into tribes and sub tribes, we now divide these again into genera. Let us see if we can clearly define each genus so as to make it easily recognizable. For convenience, we will consider the genera under the heading of its proper tribe and sub tribe.

KEY TO TRIBES
OF THE FAMILY CACTACEAE

- A. Leaves persistent, either broad and flat (Fig. 1), or awl shaped (Fig. 2); glochids (Fig. 6) not present; flowers terminal (Fig. 3), or stalked (Fig. 4), and then often clustered Tribe I. PERESKIEAE
- AA. Leaves usually falling off soon, awl shaped or broad and thick, or entirely lacking; flowers not stalked (Fig. 5).
- B. Areoles bearing glochids (Fig. 6); vegetative parts bearing leaves which are often small (Fig. 7), and short lived; flowers wheel shaped (Fig. 8), except in *Nopalea* and *Tacinga* which have erect petals Tribe II. OPUNTIEAE
- BB. Areoles without glochids; vegetative parts without leaves (except cotyledonary); flowers with definite tubes (Fig. 9), except *Rhipsalis* Tribe III. CEREAE

ILLUSTRATED IN PLATE 1

- FIG. 1. Stem of *Pereskia*
 FIG. 2. & 3. *Maihuenia Poepigii*
 FIG. 4. *Pereskia* flowers
 FIG. 5. *Opuntia* flower
 FIG. 6. Glochids in areoles
 FIG. 7. Young joint of *Opuntia*
 FIG. 8. *Opuntia* type flower
 FIG. 9. *Cereus* type flower

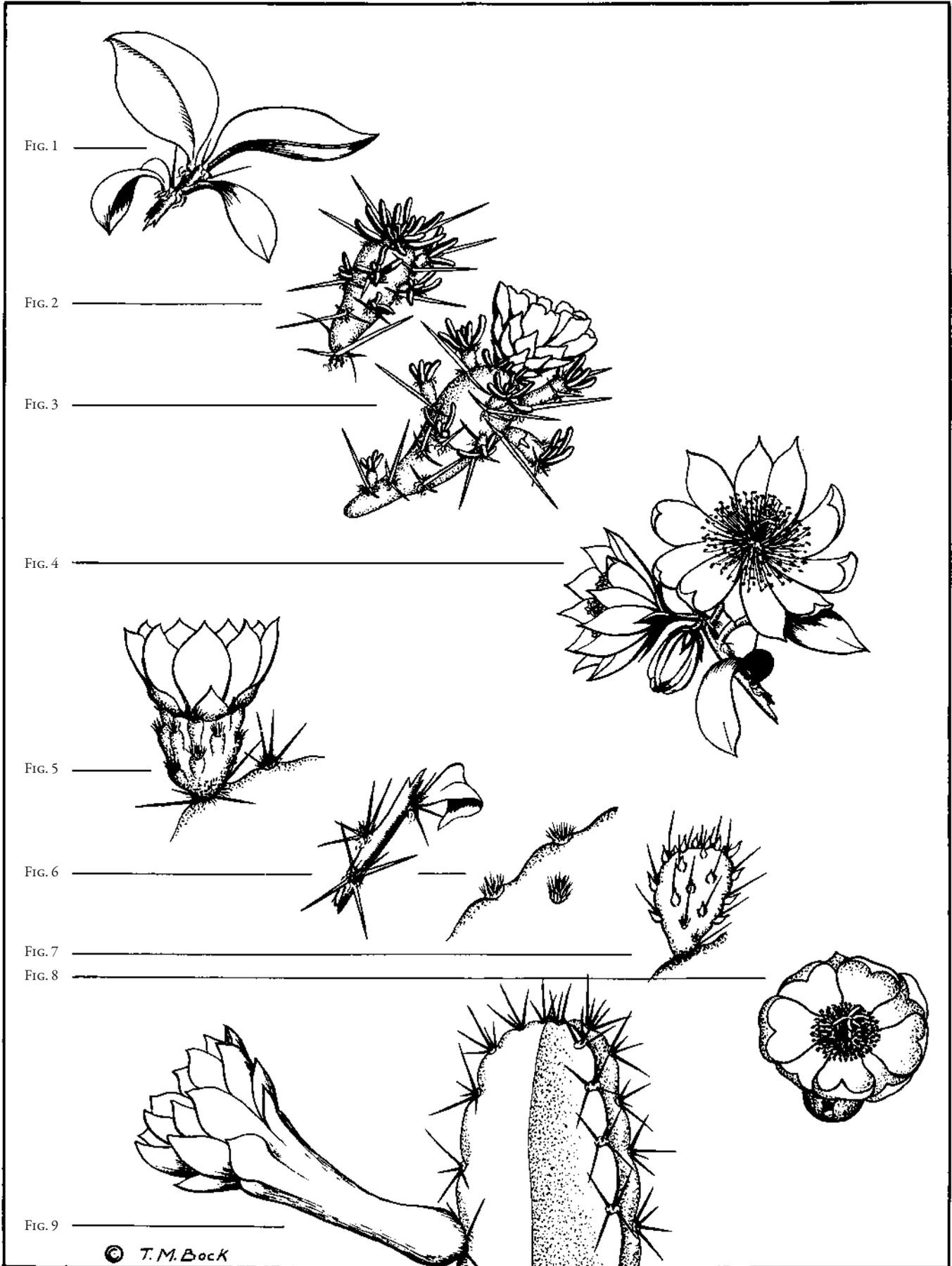


PLATE 1 (three-fourths size)

TRIBE 1. PERESKIEAE

KEY TO GENERA

- A. Leaves broad and flat (Fig. 1) flowers stalked (Fig. 2). Genus 1. *Pereskia*
 - B. Ovary a primitive hollow in the base of the pistil (Fig. 3); ovules solitary on short stalks (Fig. 4)—Sub genus A. *Eupereskia*;
 - BB. Ovary a true chamber with parietal placentation (Fig. 5)
—Sub genus B. *Rhodocactus*;
- AA. Leaves terete (Fig. 6); ovary primitive; flowers terminal (Fig. 7). Genus 2. *Maihuenia*

ILLUSTRATED IN PLATE 2

FIG. 1. *Pereskia* stemFIG. 2. *P. guamacho* flowerFIG. 3. *P. aculeata* flowerFIG. 4. *P. aculeata* flowerFIG. 5. *P. portulacifolia* flowerFIG. 6. *Maihuenia Poeppigii*FIG. 7. *M. Poeppigii* flower

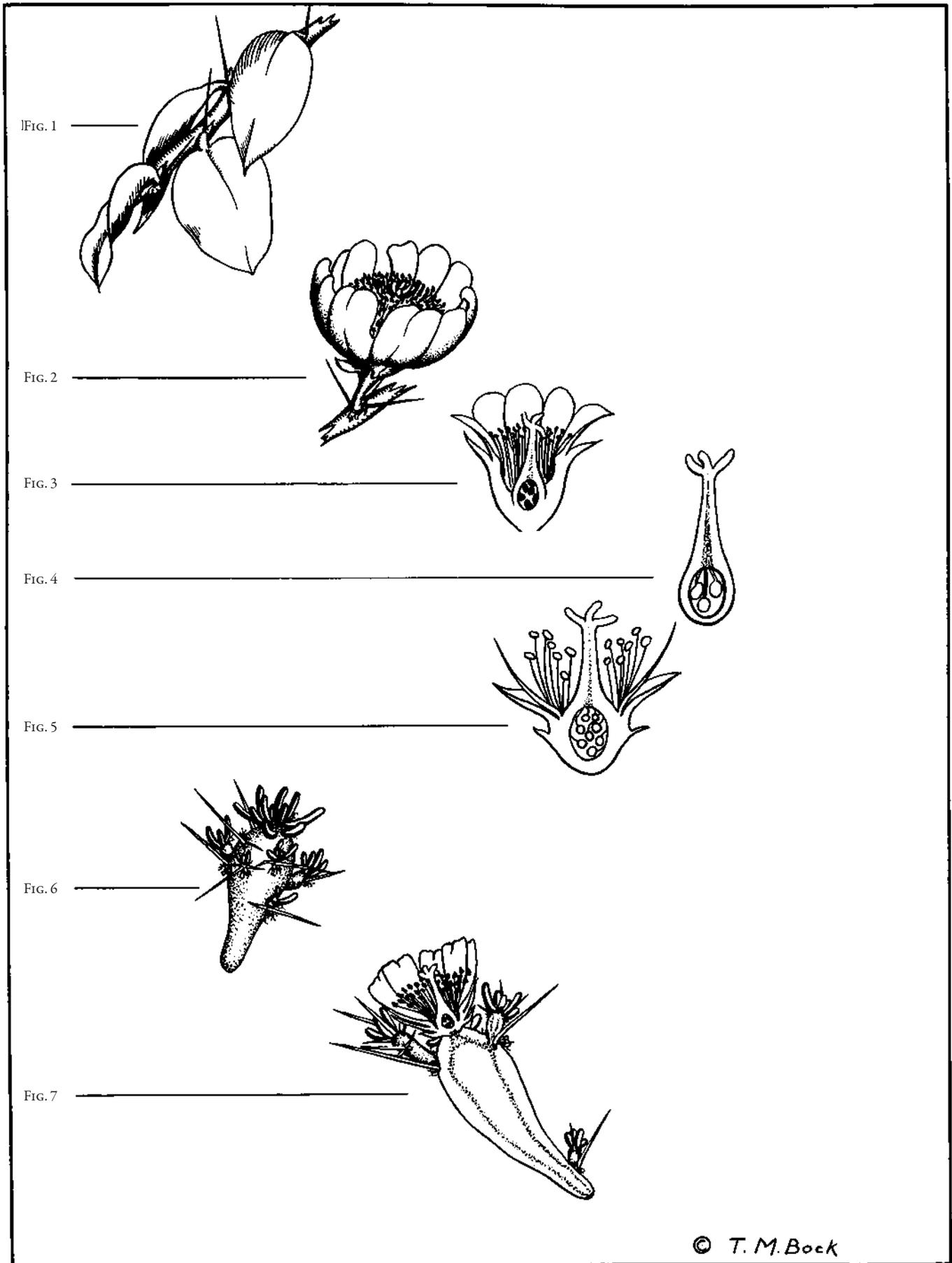


PLATE 2 (three-fourths size)

TRIBE II. OPUNTIEAE

KEY TO GENERA

- A. Leaves flat and thickened (Fig. 1);
 - B. Seeds bony, covered with matted hairs (Fig. 1) Genus 1. *Pereskiopsis*
 - BB. Seeds white, hard and bony, naked (Fig. 2) Genus 2. *Quiabentia*
- AA. Leaves awl shaped;
 - C. Seeds broadly winged (Fig. 3). Genus 3. *Pterocactus*
- CC. Seeds wingless;
 - D. Stamens much longer than petals;
 - Petals erect; joints flat (Fig. 4) Genus 4. *Nopalea*
 - Petals recurved; joints round (Fig. 5) Genus 5. *Tacinga*
 - DD. Stamens shorter than the petals;
 - Joints flat or terete, not ribbed;
 - Testa of seed thin, black, shining (Fig. 6) Genus 6. *Maihueniopsis*
 - Testa of seed thick, pale, dull. Genus 7. *Opuntia*
 - Joints terete, ribbed (Fig. 8). Genus 9. *Grusonia*
 - Joints terete in age, flat when young; fruit much flattened
(Fig. 7). Genus 8. *Consolea*

ILLUSTRATED IN PLATE 3

- FIG. 1. *Pereskiopsis velutina* stem and seed
- FIG. 2. *Quiabentia* seed
- FIG. 3. *Pterocactus* stem and seed
- FIG. 4. *Nopalea delecta* joint with bud and flower
- FIG. 5. *Tacinga funalis* joint and flower
- FIG. 6. *Maihueniopsis Molfnii* joints
- FIG. 7. *Consolea falcata* tip of joint with flowers
- FIG. 8. *Grusonia Bradtiana* tip of joint

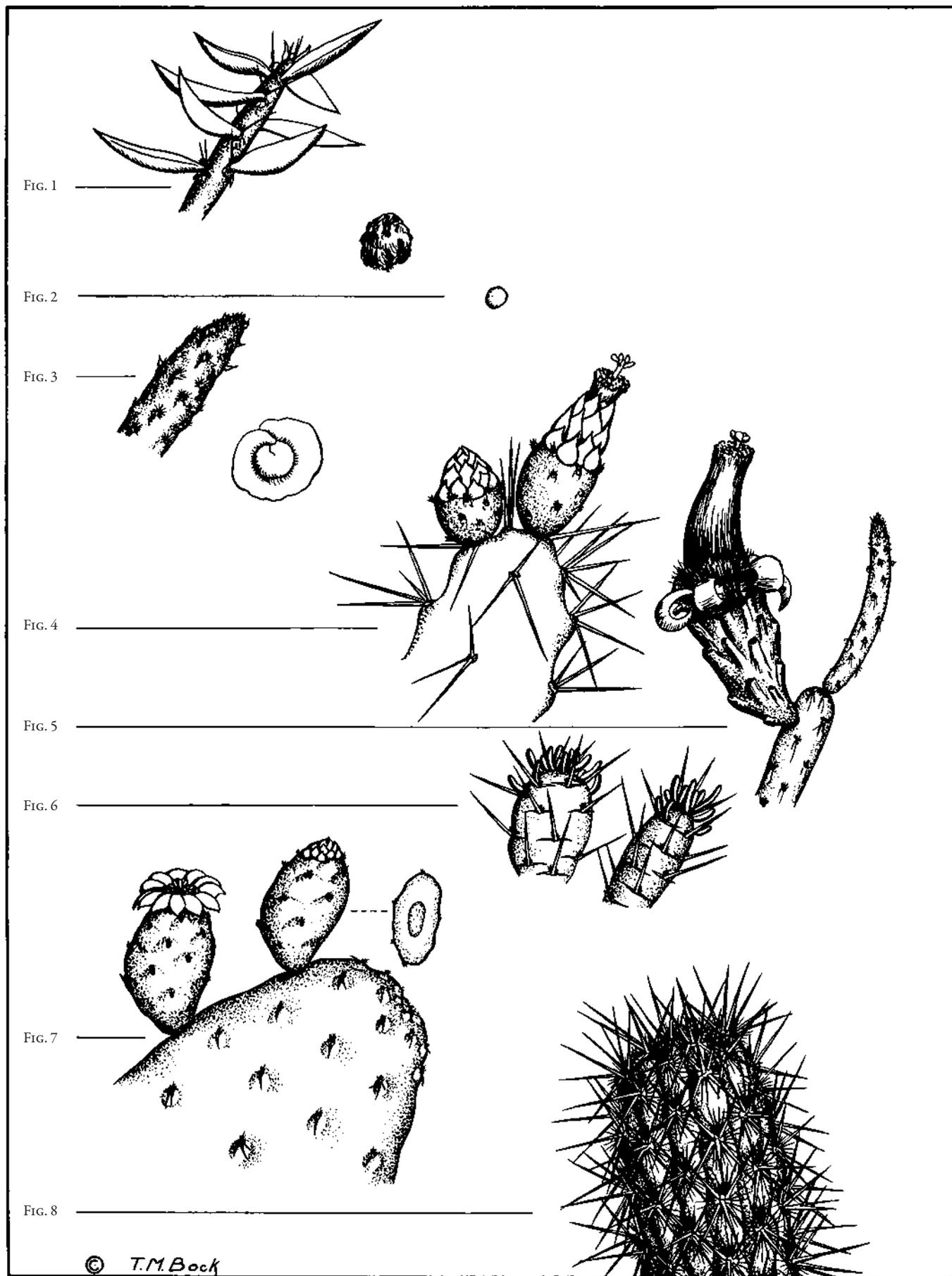


PLATE 3 (three-fourths size)

Tribe III. CEREEAE

KEY TO SUB-TRIBES

- A. Tubedefinite; perianth funnellform, salverform, tubular or campanulate (Plate E), segments several to many;
- B. Areoles mostly spine bearing; joints ribbed, angled to tubercled;
- C. Flowers and spines borne at the same areoles;
- D. Several jointed to many jointed cacti, joints long;
- Erect, bushy, arching or diffuse cacti (Fig. 1) . . . Sub tribe 1. CEREEANAE
- Vine like cacti with aerial roots (Fig. 2) Sub tribe 2. HYLOCEREANAE
- DD. One jointed or few jointed cacti, joints usually short, sometimes clustered, ribbed or rarely tubercled;
- Flower at lateral areoles (Fig. 3) Sub tribe 3. ECHINOCEREANAE
- Flowers at central areoles (Fig. 4) Sub tribe 4. ECHINOCACTANAE
- CC. Flower and spines borne at different areoles; short one-jointed cacti;
- Flowering areoles borne on a central cephalium (Fig. 5). Sub tribe 5. CACTANAE
- Flowers arising from axils of tubercles or from the base of a groove on the upper side of the tubercles (Fig. 6) Sub tribe 6. CORYPHANTHANAE
- BB. Areoles mostly spineless; joints many, long, flat; perianth mostly funnellform; epiphytic cacti (Fig. 7) Sub tribe 7. EPIPHYLLANAE
- AA. Tube indefinite; perianth rotate, segments few; mostly spineless, epiphytic, slender, many jointed cacti (Fig. 8) Sub tribe 8. RHIPSALIDANAE

ILLUSTRATED IN PLATE 4

- FIG. 1. *Cereus peruvianus* flower
- FIG. 2. *Hylocereus undatus* joint
- FIG. 3. *Echinocereus dasyacanthus* flower
- FIG. 4. *Echinocactus horizontalonius* flower
- FIG. 5. *Melocactus caesius* flower and fruit
- FIG. 6. *Coryphantha robustispina* flower and tubercles
- FIG. 7. *Epiphyllum Pittieri* flower
- FIG. 8. *Rhipsalis cereuscula* flowers

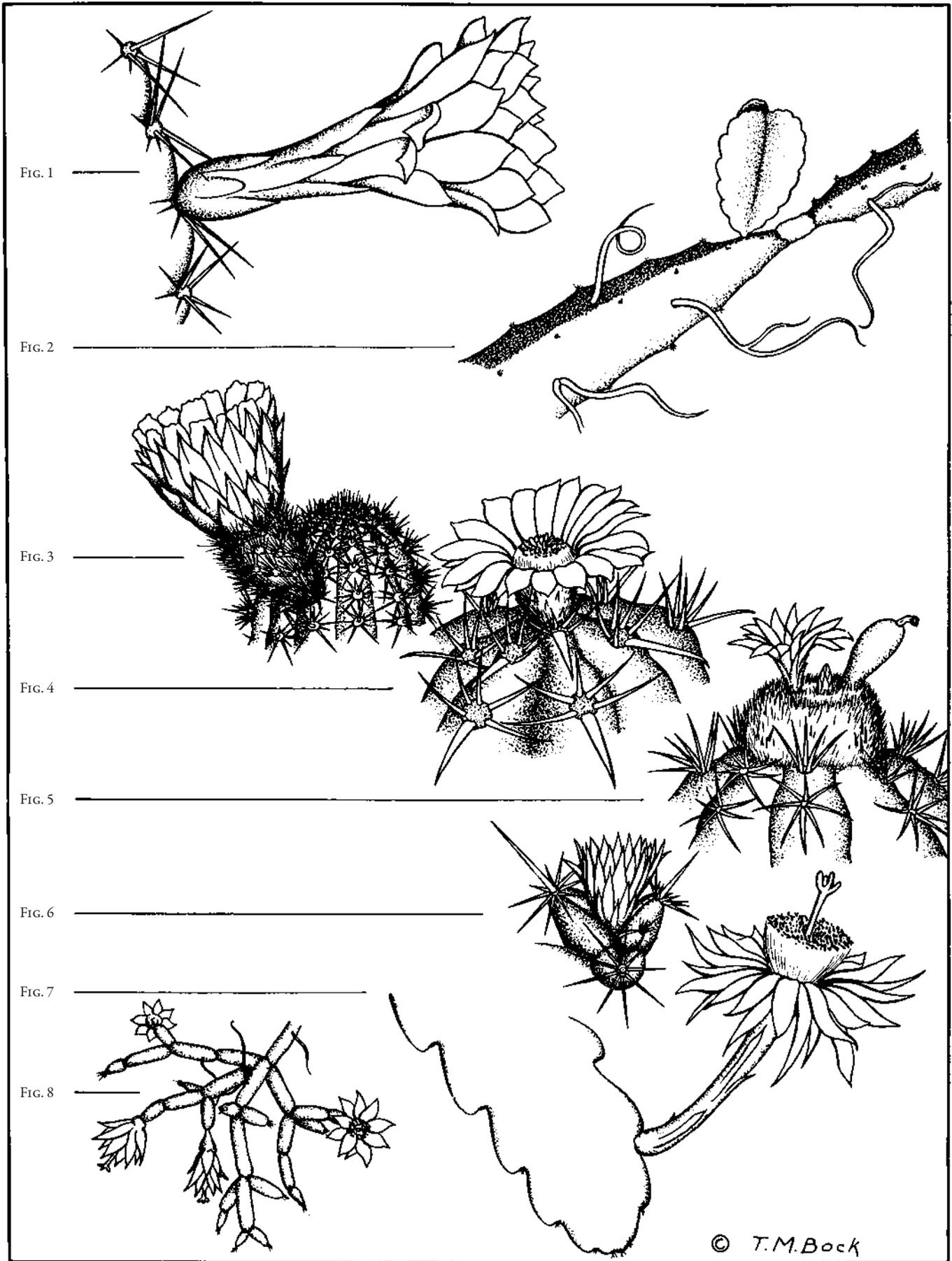


PLATE 4 (three-fourths size)

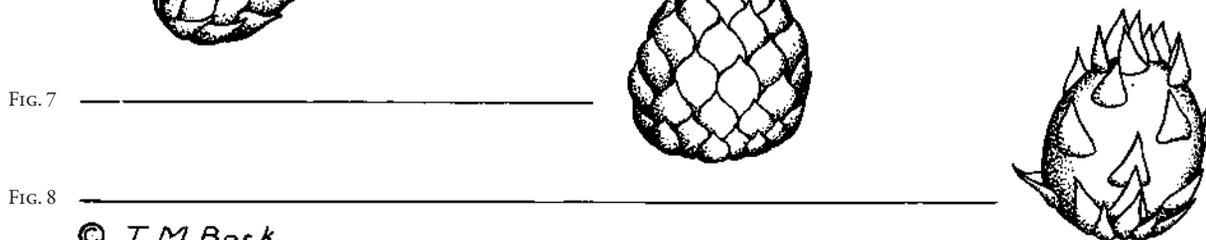
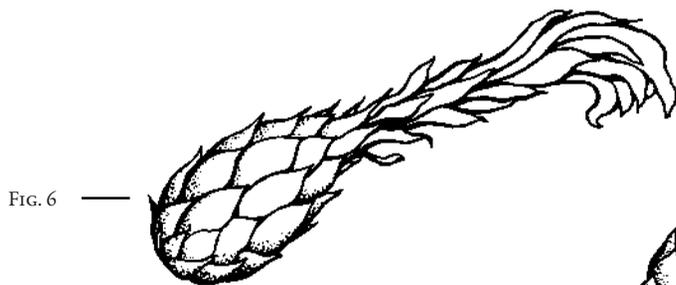
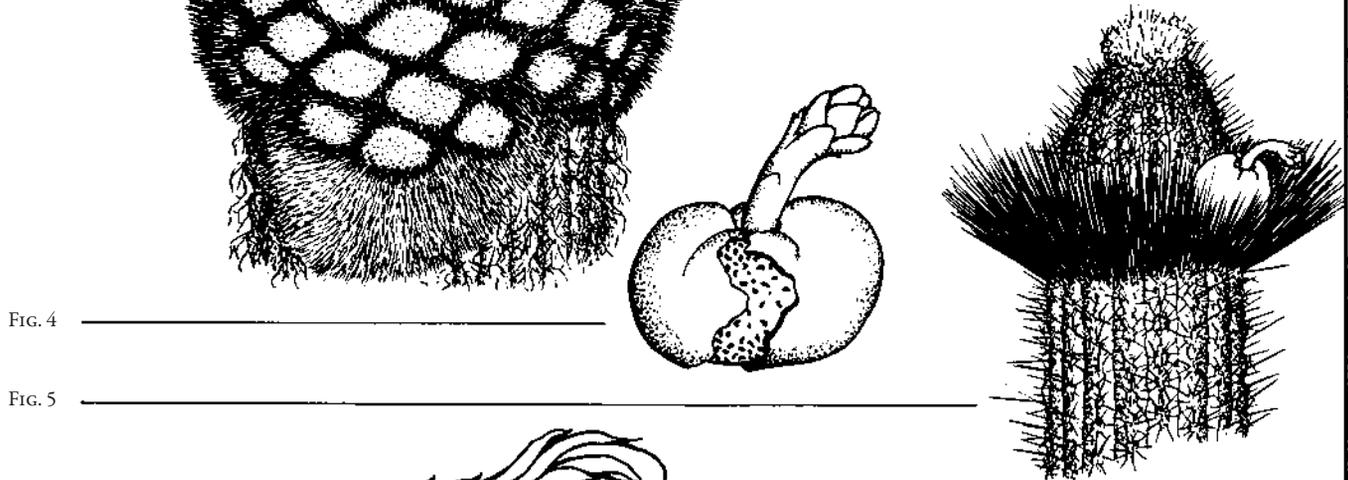
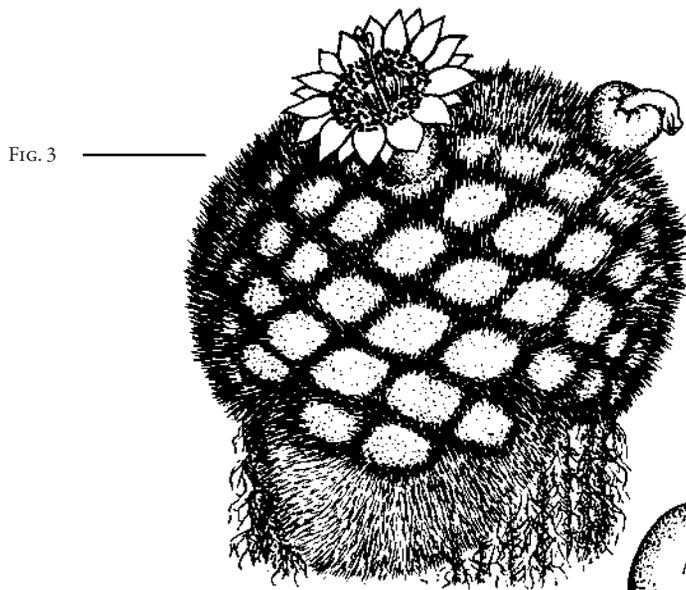
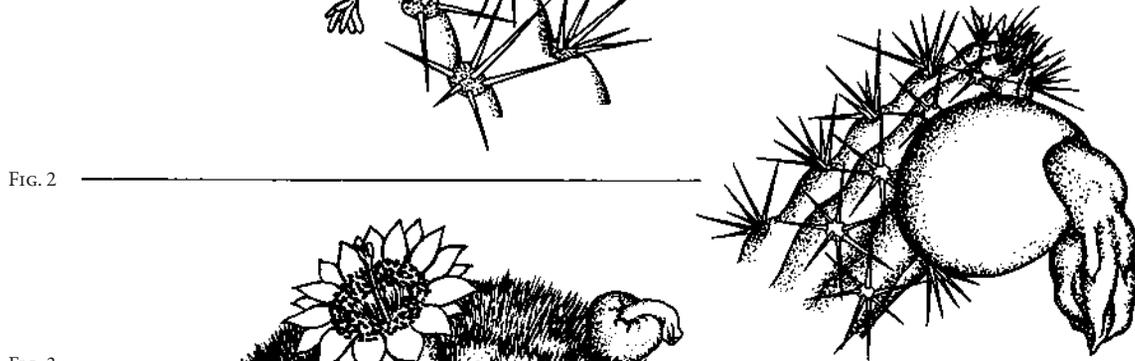
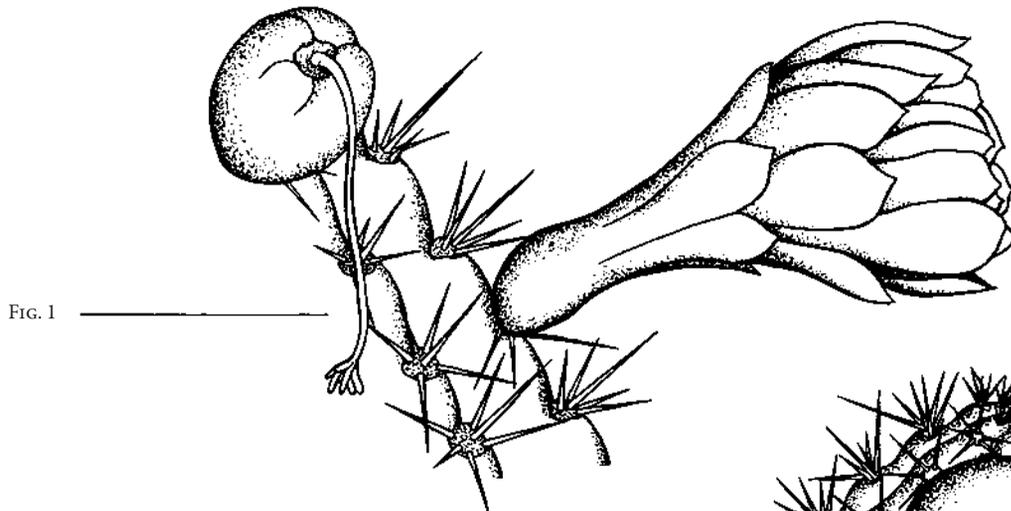
SUB-TRIBE 1. CEREEANAE

KEY TO GENERA

- A. Only one flower produced from an areole;
- B. Perianth funnellform to campanulate; limb relatively large;
- C. Ovary naked or with few scales which sometimes bear a few hairs in their axils;
- D. Fruit naked or nearly so;
- E. Flowering areoles not differing from non flowering ones; perianth funnellform;
 Columnar cacti; perianth falling from fruit leaving persistent style (Fig. 1) Genus 1. *Cereus*
 Slender, bushy cacti; perianth persistent on the Fruit (Fig. 2) Genus 2. *Monvillea*
- EE. Flowering areoles differing in armament from non flowering ones; perianth short funnellform to short campanulate;
 Fruit top shaped; forced out of cephalium when ripe (Fig. 3) Genus 3. *Cephalocereus*
 Fruit flattened ball shaped; dehiscing by splitting (Fig. 4) Genus 4. *Pilocereus*
 Fruit oval; produced from an encircling cephalium (Fig. 5) Genus 5. *Stephanocereus*
- DD. Fruit covered with scales;
- Scales on the ovary fleshy;
 Scales acute; easily detached from ripened fruit (Fig. 6) . . Genus 6. *Browningia*
 Scales broad; persistent on ripened fruit (Fig. 7). Genus 7. *Stetsonia*
 Scales on the ovary and fruit papery (Fig. 8) Genus 8. *Escontria*

ILLUSTRATED IN PLATE 5

- FIG. 1. *Cereus peruvianus* flower and fruit
 FIG. 2. *Monvillea Cavendishii* fruit
 FIG. 3. *Cephalocereus senilis* cephalium
 FIG. 4. *Pilocereus Royenii* fruit
 FIG. 5. *Stephanocereus leucostele* cephalium
 FIG. 6. *Browningia candelaris* fruit
 FIG. 7. *Stetsonia coryne* fruit
 FIG. 8. *Escontria chiotilla* fruit



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PLATE 5 (three-fourths size)

SUB-TRIBE I. CEREEANAE—*continued*

KEY TO GENERA

- CC. Ovary with scales which bear wool, felt or spines in their axils;
- F. Perianth short funnellform or short campanulate, its tube short and thick;
- G. Perianth short campanulate;
- Perianth falling away; flowers yellow (Fig. 9) Genus 9. *Corryocactus*
- Perianth persistent; flowers not yellow;
- Fruit dry; columnar cacti (Fig. 10) Genus 10. *Pachycereus*
- Fruit a juicy berry;
- Tree like or bushy cacti. Genus 11. *Leptocereus*
- Columnar cacti Genus 12. *Eulychnia*
- GG. Perianth short funnellform; fruit fleshy;
- White to pink flowers; not widely expanded;
- Columnar cacti (Fig. 11) Genus 13. *Lemaireocereus*
- Vine like cacti Genus 14. *Leocereus*
- Red, purple or yellow flowers, widely expanded;
- Branches slender; ribs few to several (Fig. 12). Genus 15. *Erdisia*
- Branches stout, many ribbed Genus 16. *Bergerocactus*
- Rootstocks tuberous (Fig. 13) Genus 17. *Wilcoxia*
- White, nocturnal flowers; rootstocks tuberous Genus 18. *Neoevansia*
- FF. Perianth funnellform, funnellform campanulate or salverform;
- H. Areoles of the ovary bearing spines or bristles;
- Slender cacti with large, fleshy roots; flower salverform (Fig. 14) Genus 19. *Peniocereus*
- Stout or slender cacti without large, fleshy roots; flowers funnellform;
- Tree like cacti; fruit with a thick, woody rind; ovary with few spines Genus 20. *Dendrocereus*
- Prostrate, bushy or vine like cacti; fruit fleshy;
- Bushy or prostrate cacti; spines dagger like (Fig. 15) . . . Genus 21. *Machaerocereus*
- Slender or weak cacti; spines acicular or subulate;
- Tube as long as limb; elongated, cacti; flower white;
- Joints ribbed;
- Perianth segments and filaments elongated. (Fig. 16) Genus 22. *Nyctocereus*
- Perianth segments and filaments short (Fig. 17) . . Genus 23. *Brachycereus*
- Joints angled Genus 24. *Acanthocereus*
- Tube longer than limb; one jointed or short Jointed cacti Genus 25. *Arthrocareus*
- Tube mostly shorter than limb; bushy cacti (Fig. 18) . . Genus 26. *Heliocereus*

ILLUSTRATED IN PLATE 6

FIG. 9. *Corryocactus brachypetalus* flower and fruit
 FIG. 10. *Pachycereus pecten aboriginum* fruit
 FIG. 11. *Lemaireocereus hystrix* flower
 FIG. 12. *Erdisia squarrosa* flower
 FIG. 13. *Wilcoxia* and *Neoevansia* rootstocks

FIG. 14. *Peniocereus* rootstock
 FIG. 15. *Machaerocereus eruca* spine cluster
 FIG. 16. *Nyctocereus serpentinus* flower
 FIG. 17. *Brachycereus Thouarsii* flower
 FIG. 18. *Heliocereus cinnabarinus* flower

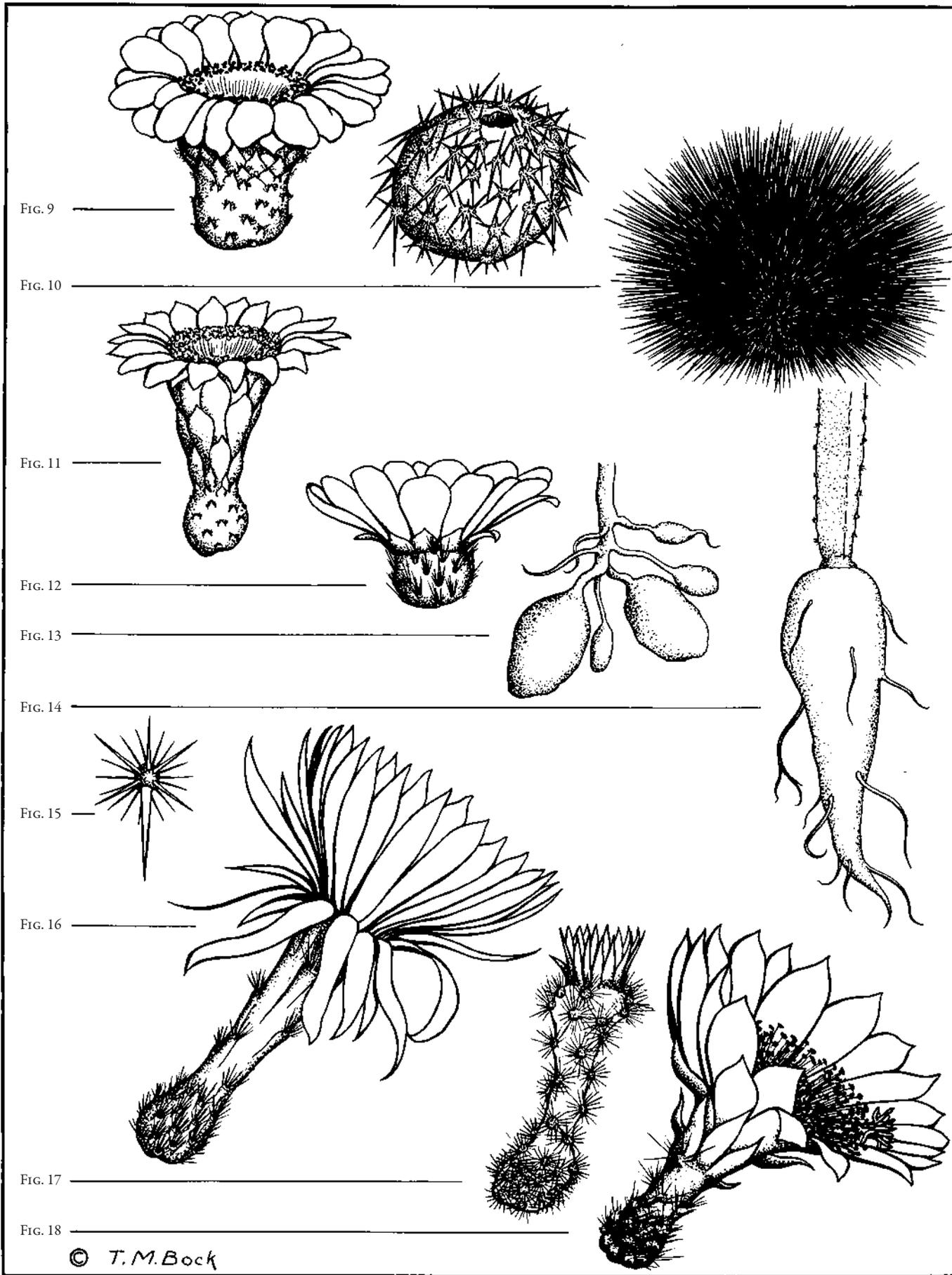


PLATE 6 (three-fourths size)

SUB-TRIBE CEREEANAE—*continued*

KEY TO GENERA

- HH. Areoles of the ovary woolly, felted or bristly;
 Perianth funnellform or salverform; tube mostly longer than limb;
 Stout, upright cacti (except *Trichocereus thelegonus*)
 Tube bearing areoles to top (Fig. 19) Genus 27. *Trichocereus*
 Tube slender with few or no areoles (Fig. 20) Genus 28. *Jasminocereus*
 Slender, arching, vine like or bushy cacti;
 Arching cacti; fruit yellow to orange, indehiscent . . . Genus 29. *Harrisia*
 Vine like cacti; fruit red, dehiscent
 Genus 30. *Eriocereus*
 Perianth funnellform campanulate, the tube stout;
 Gigantic cacti; scales on tube broad (Fig. 21) Genus 31. *Carnegiea*
 Stout, bushy cacti; scales on tube narrow (Fig. 22) Genus 32. *Binghamia*
- EEE. Flowering areoles producing wool, bristles or both;
 Cephalium terminal;
 Stem continuing growth through cephalium leaving a collar of hairs;
 Flowers white, nocturnal (Fig. 23) Genus 5. *Stephanocereus*
 Flowers red, diurnal (Fig. 24) Genus 33. *Arrojadoa*
 Stem not continuing growth through cephalium;
 Flowers white (Fig. 25) Genus 34. *Neoabbotia*
- Cephalium lateral, sometimes near top of stem;
 Ovary and tube naked or with few scales;
 Fruit top shaped (Fig. 26) Genus 3. *Cephalocereus*
 Fruit flattened ball shaped. Genus 4. *Pilocereus*
 Ovary and tube with scales, these bearing hairs in their axils (Fig. 28) . Genus 35. *Facheiroa*
 Cephalium from central axis; ovary scaly and tube hairy (Fig. 27) . . . Genus 36. *Espostoa*

ILLUSTRATED IN PLATE 7

- FIG. 19. *Trichocereus Terscheckii* flower
 FIG. 20. *Jasminocereus galapagensis* flower
 FIG. 21. *Carnegiea gigantea* flower
 FIG. 22. *Binghamia acrantha* flower
 FIG. 23. *Stephanocereus leucosteles* flower
 FIG. 24. *Arrojadoa rhodantha* flower
 FIG. 25. *Neoabbotia paniculata* flower
 FIG. 26. *Cephalocereus senilis* flower
 FIG. 27. *Espostoa lanata* flower
 FIG. 28. *Facheiroa Ulei* flower

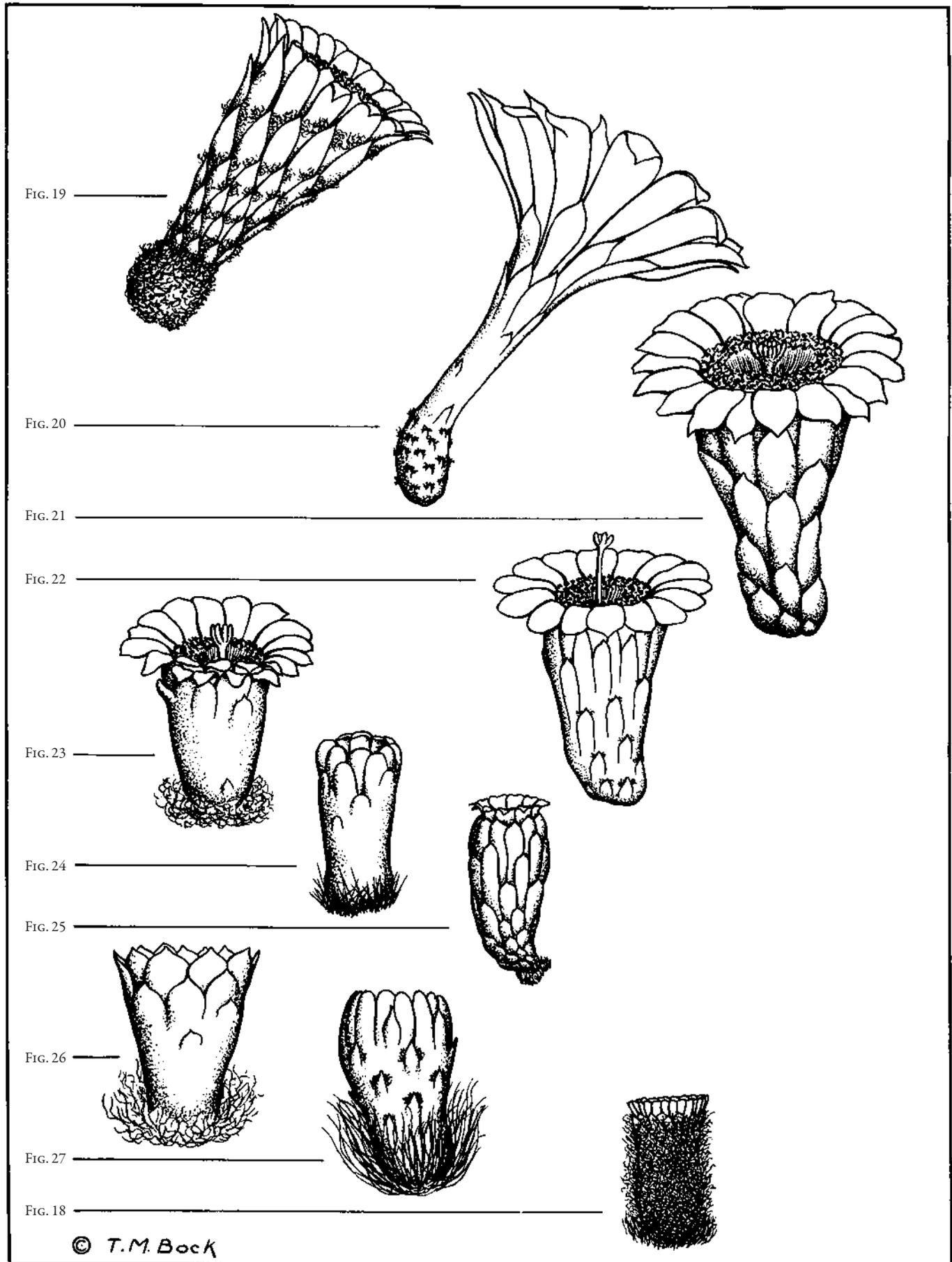


PLATE 7 (three-fourths size)

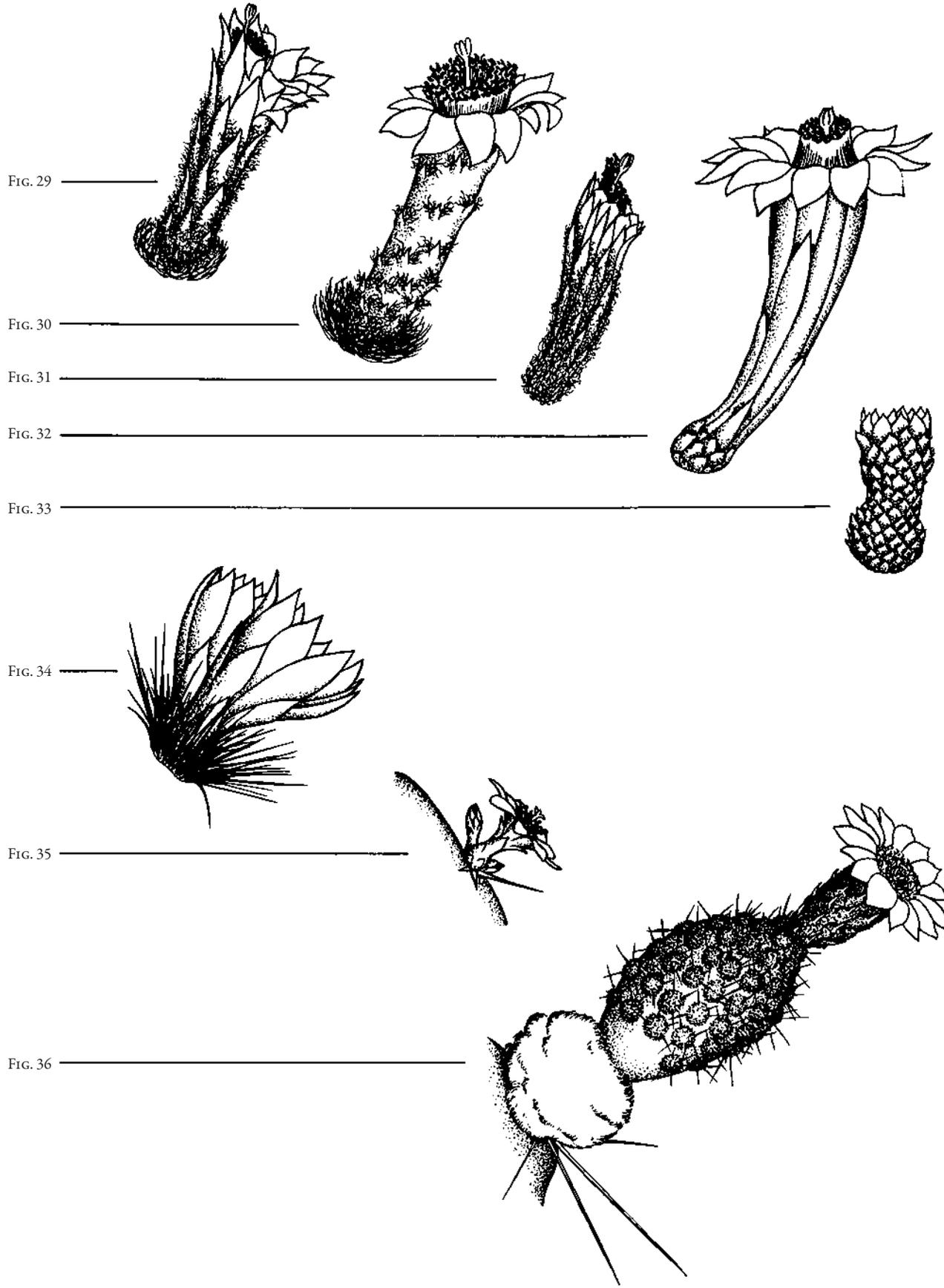
SUB-TRIBE 1. CEREEANAE—*continued*

KEY TO GENERA

- BB. Perianth sub cylindrical; limb short;
- Scales on ovary and tube, when present, naked in their axils. . . . Genus 33. *Arrojadoa*
- Scales on ovary and tube bearing long, silky hairs (Fig. 29) Genus 37. *Borzicactus*
- Scales on ovary and tube woolly in their axils;
- Flowers produced from a cephalium;
- Flower tube elongated; fruit dry (Fig. 30) Genus 38. *Oreocereus*
- Flower tube elongated; fruit juicy Genus 34. *Neoabbottia*
- Flower tube very short; fruit not dry Genus 35. *Facheiroa*
- Flowers not produced from a cephalium;
- Tube elongated, slender; stamens exserted;
- Mouth of flower scarcely opening (Fig. 31) Genus 39. *Cleistocactus*
- Segments recurved at mouth of flower (Fig. 32) Genus 40. *Rathbunia*
- Tube short; stamens included (Fig. 33) Genus 41. *Zehntnerella*
- AA. Flowers two or more from an areole; columnar cacti;
- Flowering areoles producing long bristles (Fig. 34). Genus 42. *Lophocereus*
- Flowering areoles similar to non flowering ones;
- flowers nearly rotate (Fig. 35). Genus 43. *Myrtillocactus*
- Flowering areoles enlarged, proliferous (Fig. 36) Genus 44. *Neoraimondia*

ILLUSTRATED IN PLATE 8

FIG. 29. *Borzicactus Roezlii* flowerFIG. 30. *Oreocereus Celsianus* flowerFIG. 31. *Cleistocactus Baumannii* flowerFIG. 32. *Rathbunia alamosensis* flowerFIG. 33. *Zehntnerella squamulosa* flowerFIG. 34. *Lophocereus Schottii* flowerFIG. 35. *Myrtillocactus Schenckii* flowerFIG. 36. *Neoraimondia macrostibas* flower and enlarged, proliferous areoles



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PLATE 8 (three-fourths size)

SUB-TRIBE 2. HYLOCERANAE

KEY TO GENERA

- A. joints angled, ribbed, winged or fluted;
- B. Ovary and fruit covered with large, leaf like scales; their axils not spiny; flowers nocturnal; stems and branches 3 angled or 3 winged;
- Tube long; flowers large; scales naked in their axils (Fig. 1) Genus 1. *Hylocereus*
- Tube very short; flowers small, some of their scales with short hairs and bristles in their axils (Fig. 2) Genus 2. *Wilmattea*
- BB. Ovary and fruit without leaf like scales; scale axils spiny, hairy or bristly;
- C. Flowers long funnelform, very large, nocturnal; tube and ovary bearing scales with hairs or spines in their axils;
- Stems ribbed, fluted or angled (Fig. 3) Genus 3. *Selenicereus*

ILLUSTRATED IN PLATE 9

FIG. 1. *Hylocereus undatus* flowerFIG. 2. *Wilmattea minutiflora* flowerFIG. 3. *Selenicereus grandiflorus* flower

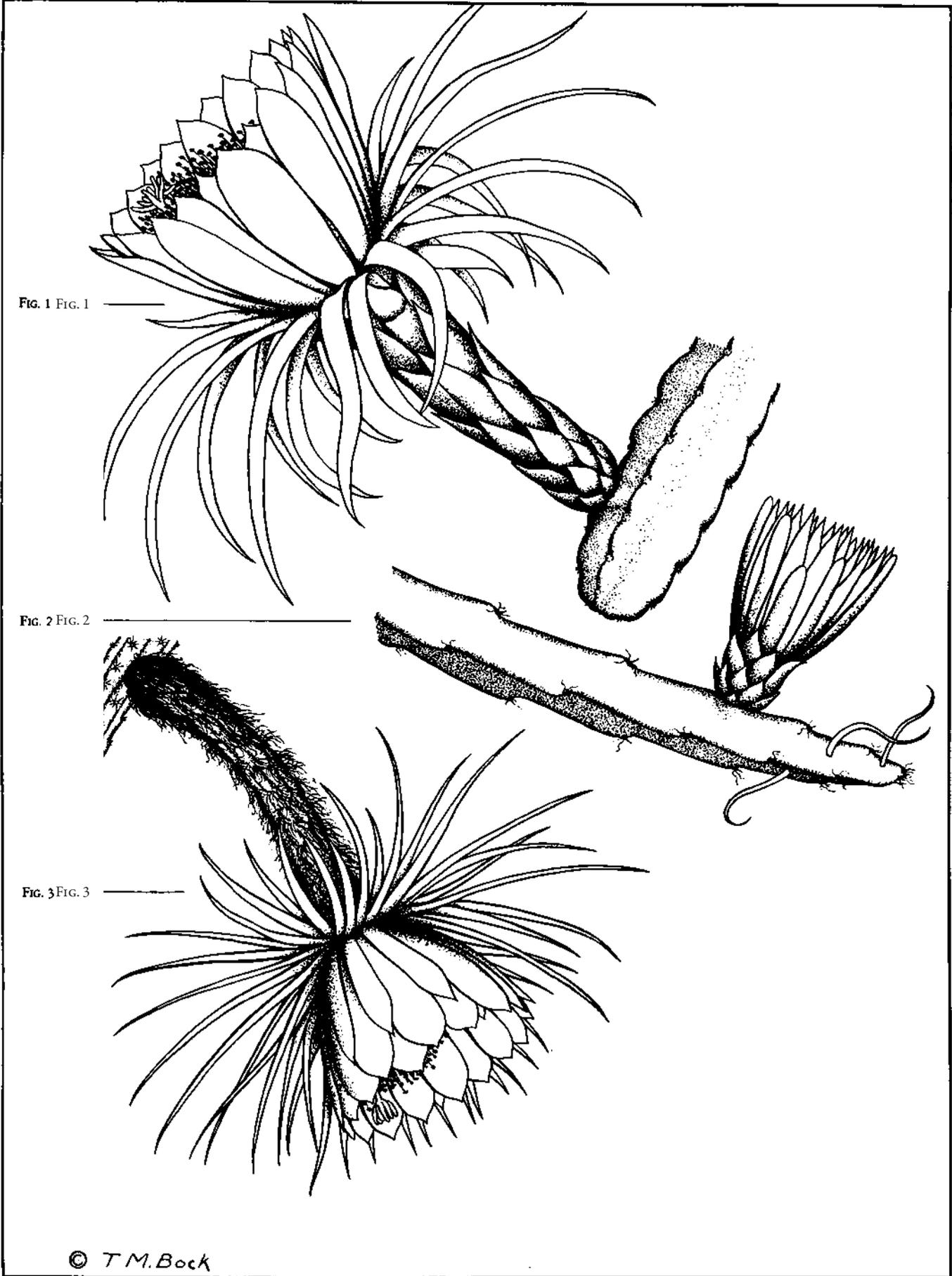


PLATE 9 (Figs. 1 and 3, one-half size; Fig. 2, three-fourths size)

SUB-TRIBE 2. HYLOCEREANAE—*continued*

KEY TO GENERA

- Stems winged;
- Scales on ovary and tube bearing felt and spines in their axils;
 flowers nocturnal (Fig. 4) Genus 4. *Mediocactus*
- Scales of ovary and tube bearing long hairs in their axils;
 flowers diurnal (Fig. 5) Genus 5. *Deamia*
- CC. Flowers short funnellform to funnellform-campanulate;
- Limb of flower regular, the tube stout; flowers white;
- Tube of flower bearing short scales; ovary tuberculate, the
 areoles bearing long hairs (Fig. 7) Genus 6. *Weberocereus*
- Tube of flower and non-tuberculate ovary bearing short, black
 spines (Fig. 6) Genus 7. *Wercklerocereus*
- Limb of flower somewhat oblique, the tube slender; flowers red
 ish (Fig. 8). Genus 8. *Aporocactus*
- AA. joints flat (Fig. 9). Genus 9. *Strophocactus*

ILLUSTRATED IN PLATE 10

- FIG. 4. *Mediocactus coccineus* flower
 FIG. 5. *Deamia testudo* flower
 FIG. 6. *Wercklerocereus Tonduzii* flower
 FIG. 7. *Weberocereus Tunilla* flower
 FIG. 8. *Aporocactus Conzattii* flower
 FIG. 9. *Strophocactus Wittii* flower

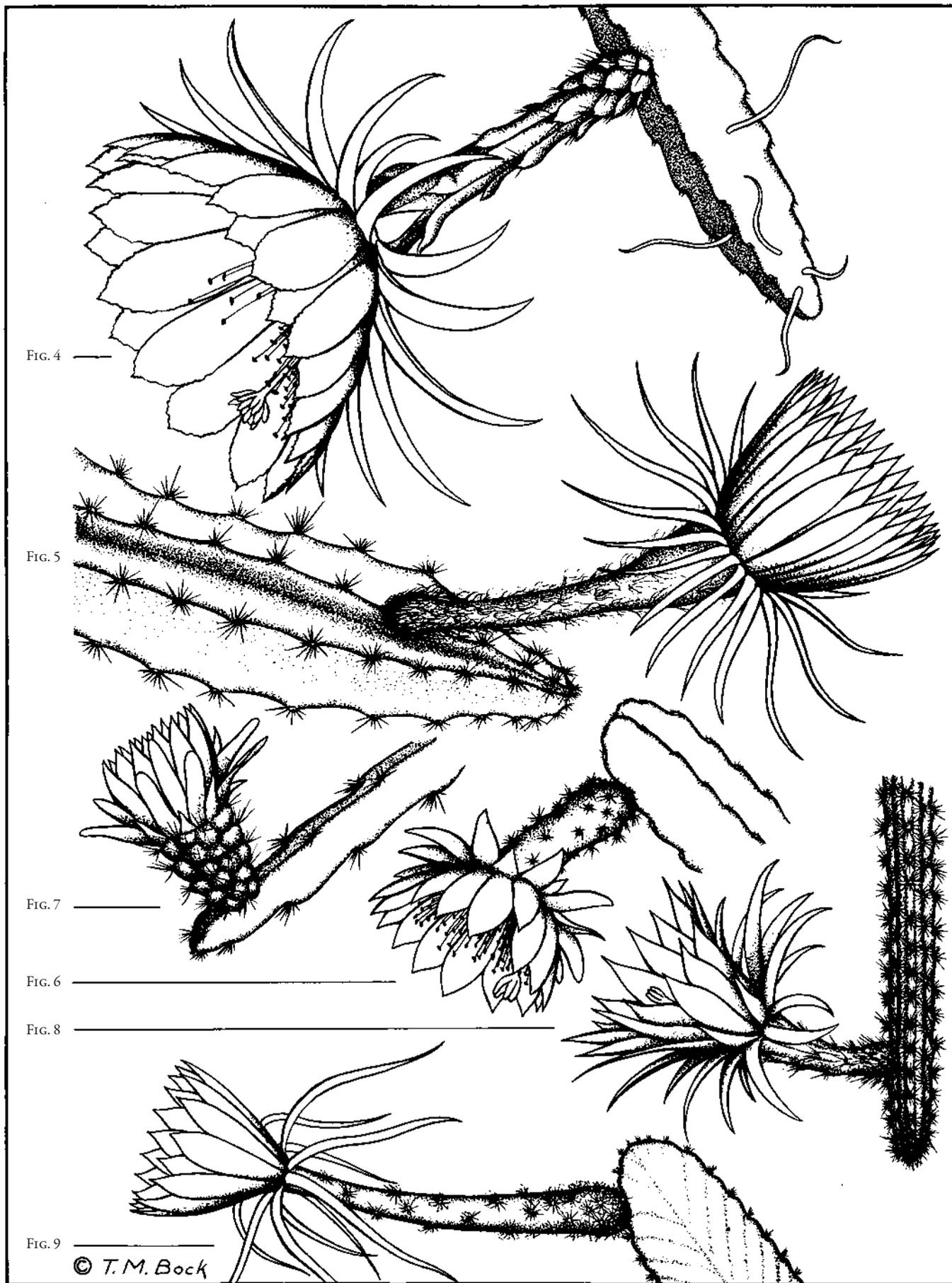


PLATE 10 (Figs. 4, 5 and 9, one-half size; Fig. 6, 7, and 8, three-fourths size)

SUB-TRIBE 3. ECHINOCEREANAE

KEY TO GENERA

- A. Ovary and fruit bearing clusters of spines at the areoles (Fig 1) Genus 1. *Echinocereus*
- AA. Ovary and fruit without clusters of spines although they may have wool or hairs on both ovary and fruit;
- B. Ribs in nearly spiral form, slightly undulate; areoles below the prominent tubercles; flowers from younger areoles; flower tube, ovary and fruit covered with rigid scales, the scales curved or erect, papery; woolly hair in their axils; ring of wool inside the tube above the ovary (Fig. 2) Genus 2. *Acanthocalycium*
- BB. Ribs, if any, more or less straight but sometimes replaced by tubercles; flowers from side or top of plant; scales on floral parts not papery; no ring of wool inside tube;
- C. Ribs lacking; spines from areoles on the tips of tubercles; flowers from side of plant; pistil enlarged in some species so as to fill the tube (Fig. 3) Genus 3. *Rebutia*
- CC. Ribs present;
- Plants small, with creeping tendency, forming clumps; axils of scales on tube hairy (Fig. 4) Genus 4. *Chamaecereus*
- Plants larger, not creeping, often forming clumps; floral tube long;
- Flower tube narrow (Fig. 5) Genus 5. *Lobivia*
- Flower tube wider and longer than petals (Fig. 6) Genus 6. *Echinopsis*

ILLUSTRATED IN PLATE 11

FIG. 1. *Echinocereus* flowerFIG. 2. *Acanthocalycium thionanthum*FIG. 3. *Rebutia minuscula*FIG. 4. *Chamaecereus Silvestrii*FIG. 5. *Lobivia janseniana*FIG. 6. *Echinopsis tubiflora*

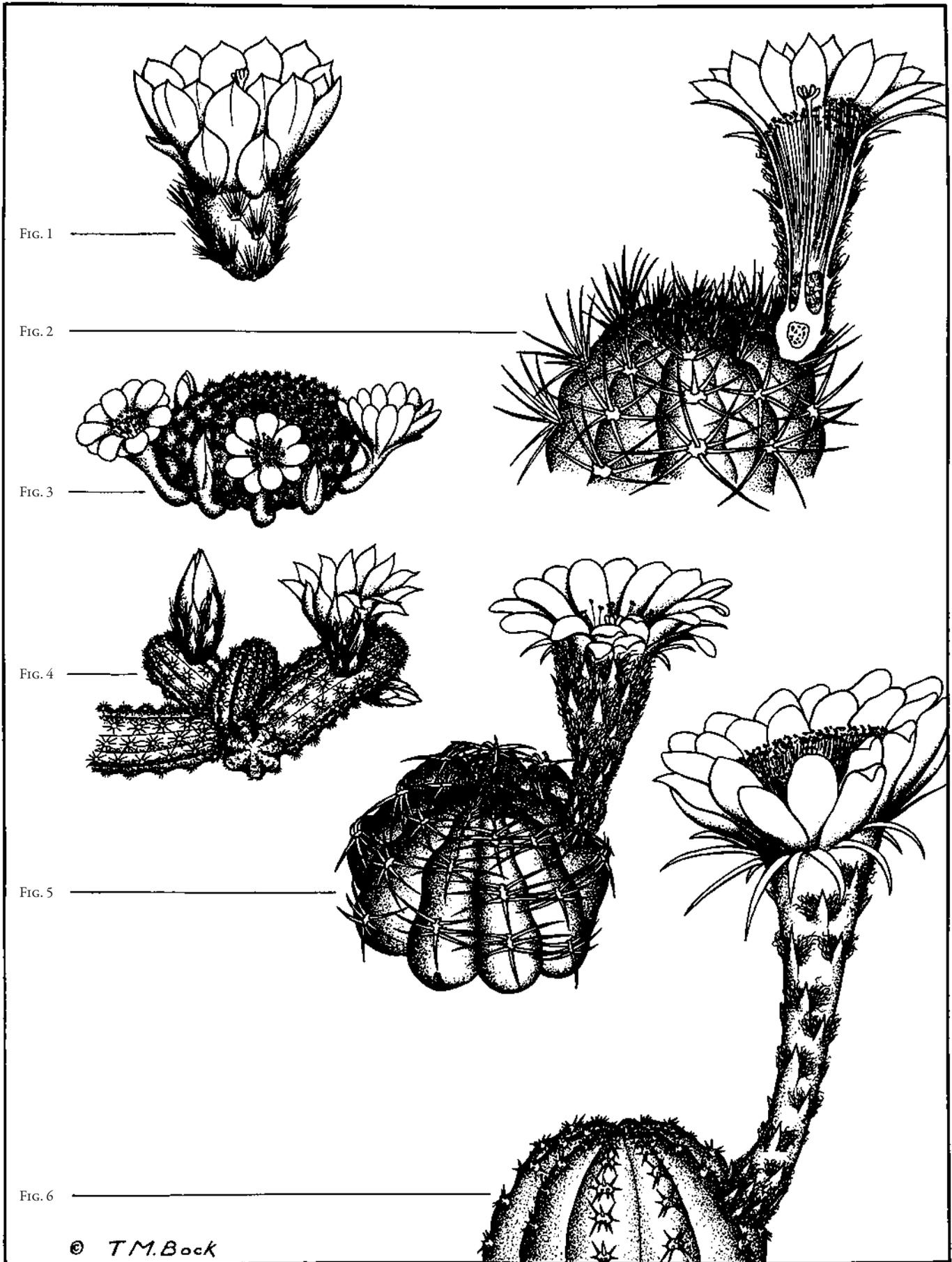


PLATE 11 (three-fourths size)

SUB-TRIBE 4. ECHINOCACTANAE

KEY TO GENERA

- A. Flower tube bent; stamens long exerted (Fig. 1) Genus 1. *Denmoza*
- AA. Flower tube straight, usually with broad throat; stamens included;
- B. Plants tuberculate; ribs indefinite;
- Tubercles cartilaginous, flattened, imbricated;
- Ovary and fruit naked; plants spineless (Fig. 2)
- Genus 2. *Ariocarpus*
- Ovary and fruit scaly; young areoles spine bearing (Fig. 3) . . . Genus 3. *Strombocactus*
- Tubercles horny, not flattened or imbricate;
- Tubercles triangular; flowers small (Fig. 4) Genus 4. *Obregonia*
- Tubercles finger like; flowers large (Fig. 3) Genus 5. *Leuchtenbergia*
- Tubercles chartaceous; in cone like formation (Fig. 6) Genus 6. *Encephalocarpus*
- Tubercles soft and flabby, rounded (Fig. 7) Genus 7. *Lophophora*

ILLUSTRATED IN PLATE 12

- FIG. 1. *Denmoza rhodacantha* flower
- FIG. 2. *Ariocarpus fissuratus*
- FIG. 3. *Strombocactus Schmiedickeanus*
- FIG. 4. *Obregonia Denegrii*
- FIG. 5. *Leuchtenbergia principis*
- FIG. 6. *Encephalocarpus strobiliformis*
- FIG. 7. *Lophophora Williamsii*

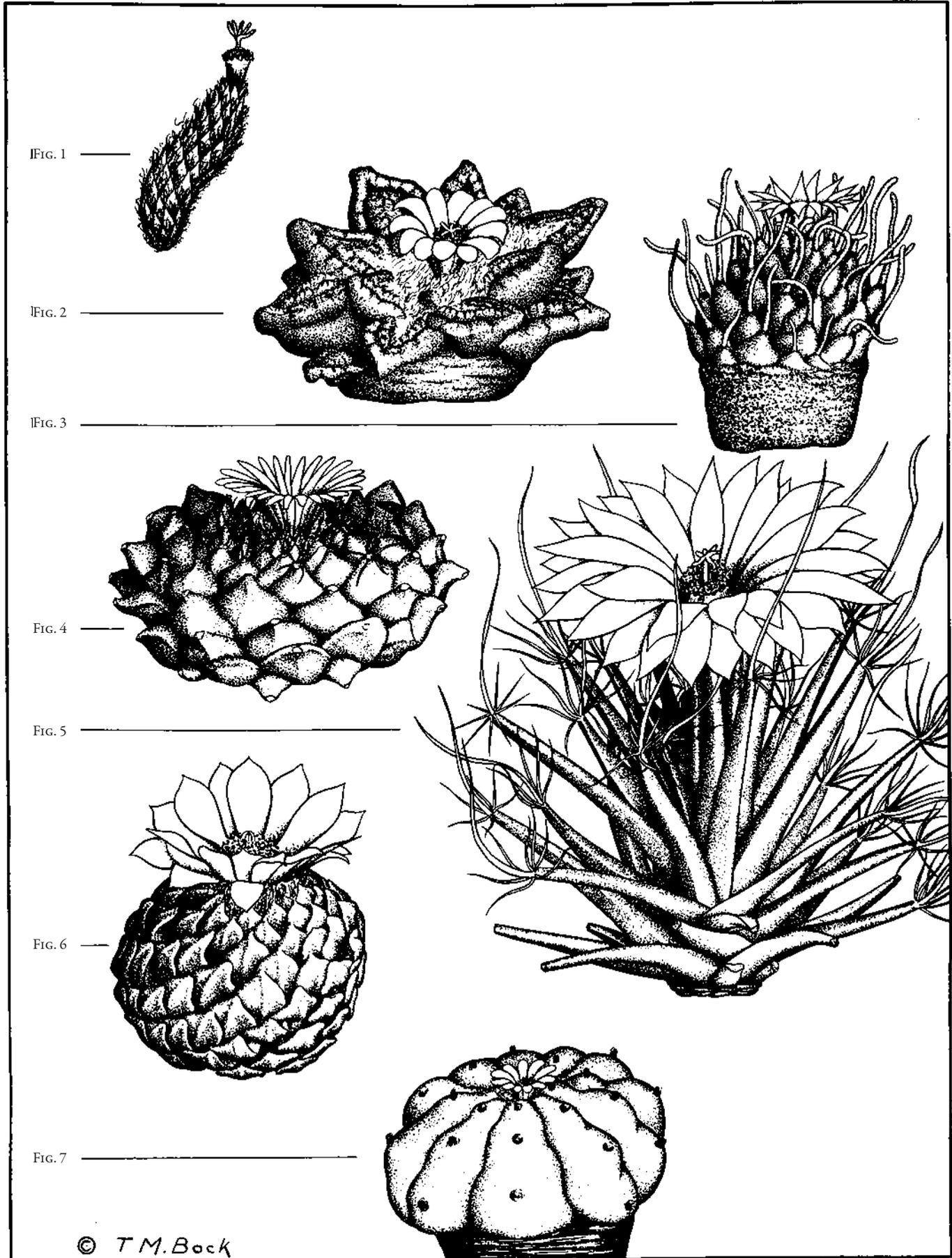


PLATE 12 (three-fourths size)

SUB-TRIBE 4. ECHINOCACTANAE—*continued*

KEY TO GENERA

- BB. Plants ribbed or tuberculate, the tubercles arranged in more or less spiralled rows;
- C. Ovary and fruit not scaly but bearing terminal appendage;
- Fruit umbilicate, crowned by sepal like scales (Fig. 8) Genus 8. *Copiapoa*
- Fruit not umbilicate; perianth persistent (Fig. 9) Genus 9. *Coloradoa*
- CC. Ovary and fruit naked;
- Fruit dry;
- Spines acicular (Fig. 10) Genus 10. *Pediocactus*
- Spines flat, papery (Fig. 11) Genus 11. *Toumeyia*
- Fruit fleshy, indehiscent;
- Plant small, tuberculate (Fig. 12). Genus 12. *Epithelantha*
- Plant ribbed, the ribs horizontally furrowed (Fig. 13) Genus 13. *Aztekium*

ILLUSTRATED IN PLATE 13

- FIG. 8. *Copiapoa coquimbana*
- FIG. 9. *Coloradoa mesae-verdae*
- FIG. 10. *Pediocactus Simpsonii*
- FIG. 11. *Toumeyia papyracantha*
- FIG. 12. *Epithelantha micromeris*
- FIG. 13. *Aztekium Ritteri*

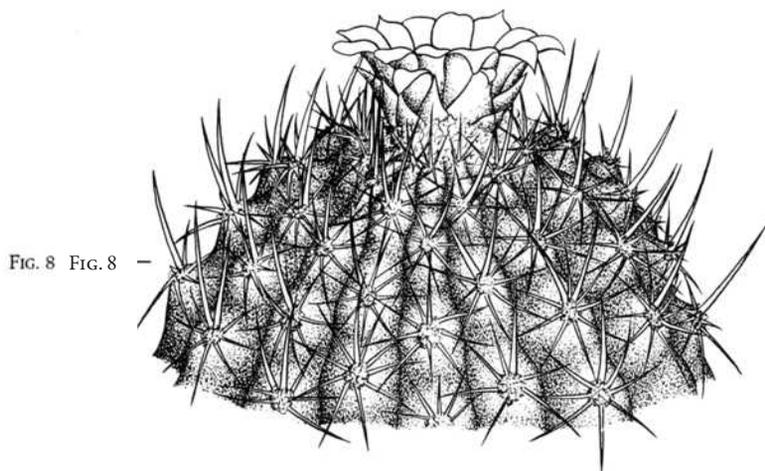


FIG. 9 FIG. 9 _____

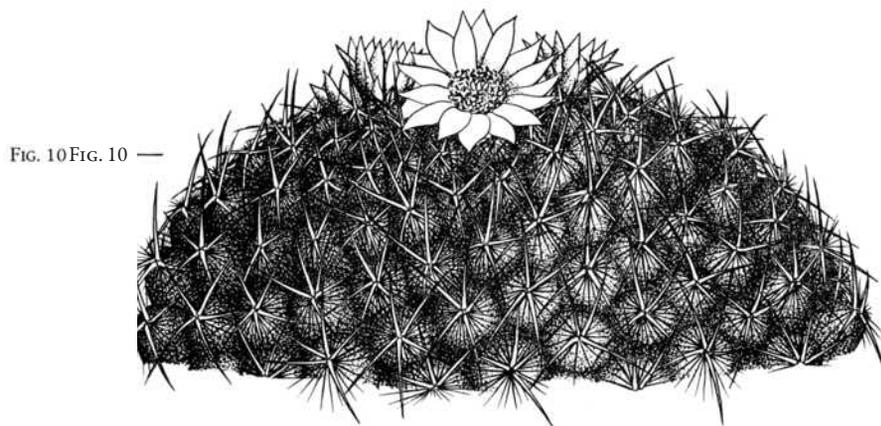
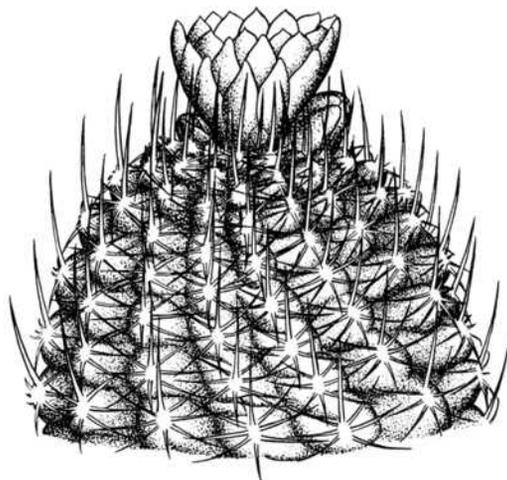


FIG. 11 FIG. 11 _____

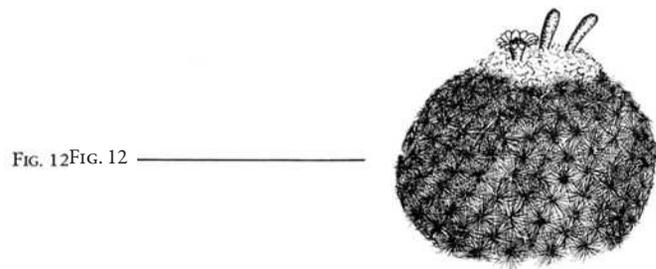
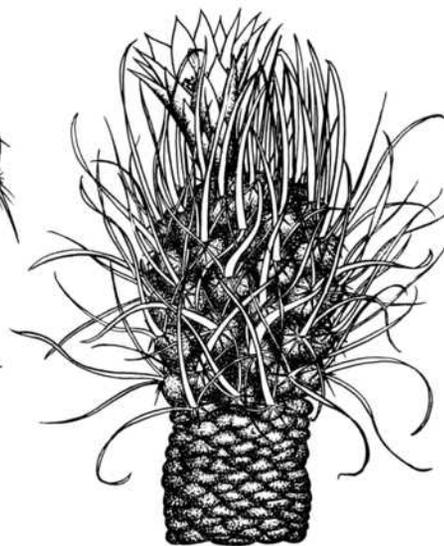


FIG. 13 FIG. 13 _____



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SUB-TRIBE 4. ECHINOCACTANAE—*continued*

KEY TO GENERA

- CCC. Ovary and fruit scaly;
- D. Flowers funnelform, often with a slender tube;
- Axils of flower scales hairy and bristly; often two flowers from one areole (Figs. 14, 15) Genus 14. *Neoporteria*
- Axils of flower scales with hairs only; one flower borne at an areole;
- Flowers long funnelform (Fig. 16) Genus 15. *Arequipa*
- Flowers short funnelform (Fig. 17) Genus 16. *Oroya*
- Axils of flower scales naked;
- tube of flower longer than limb, its scales not fringed; spines straight (Fig. 18) Genus 17. *Matucana*

ILLUSTRATED IN PLATE 14

- FIG. 14. *Neoporteria nidus*
 FIG. 13. *Neoporteria fusca*
 FIG. 16. *Arequipa leucotricha*
 FIG. 17. *Oroya Peruviana*
 FIG. 18. *Matucana Haynei*

FIG. 14 —

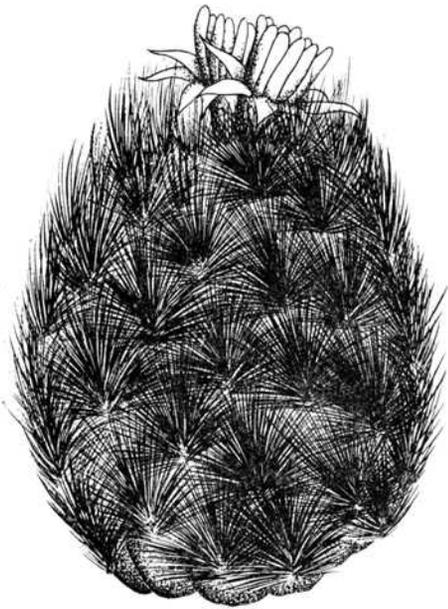


FIG. 15 —

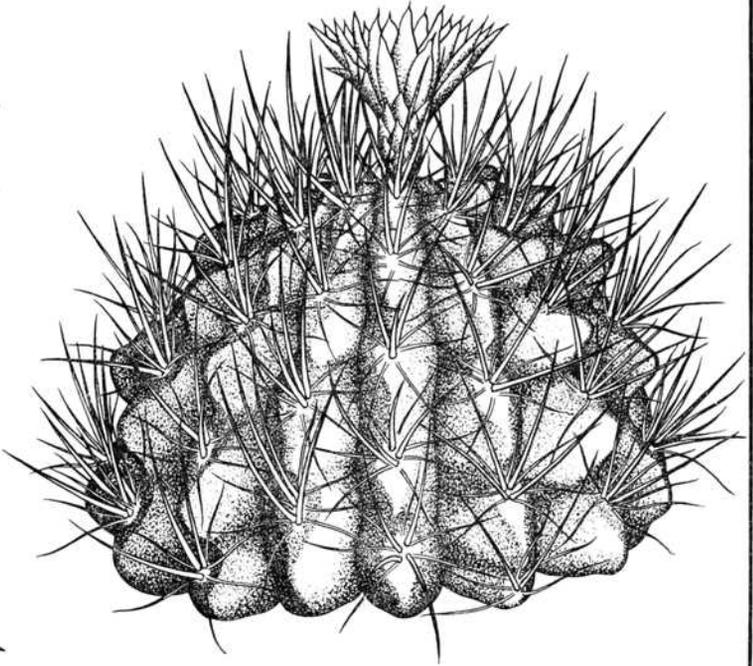


FIG. 16 —

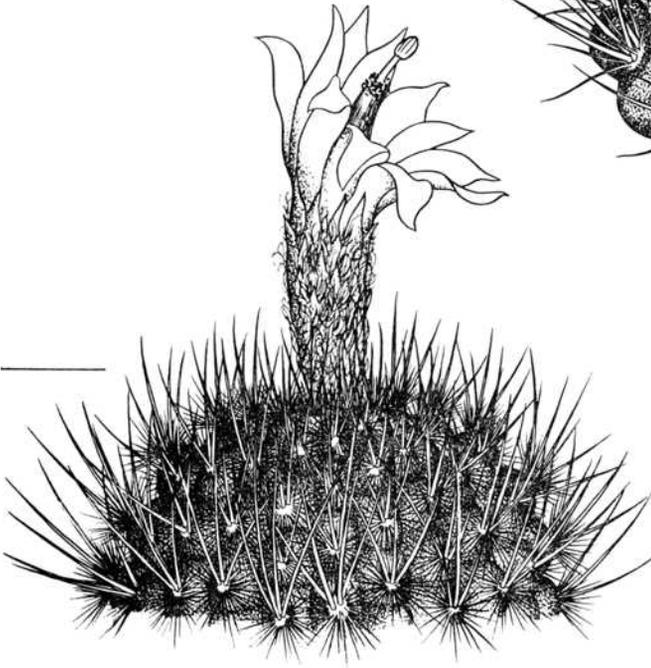


FIG. 17 —

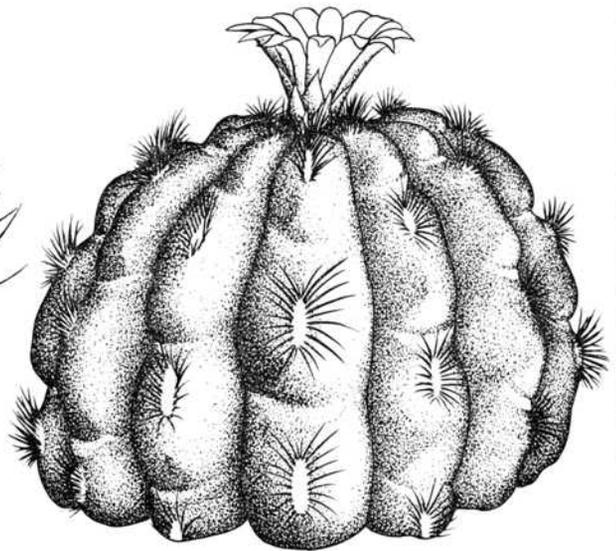
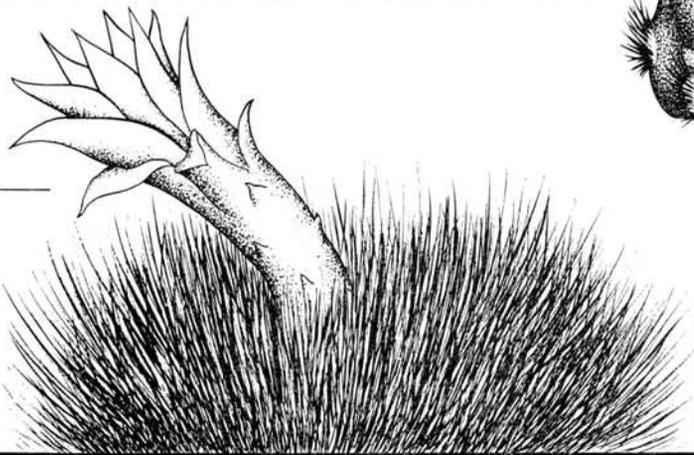


FIG. 18 —



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PLATE 14 (three-fourths size)

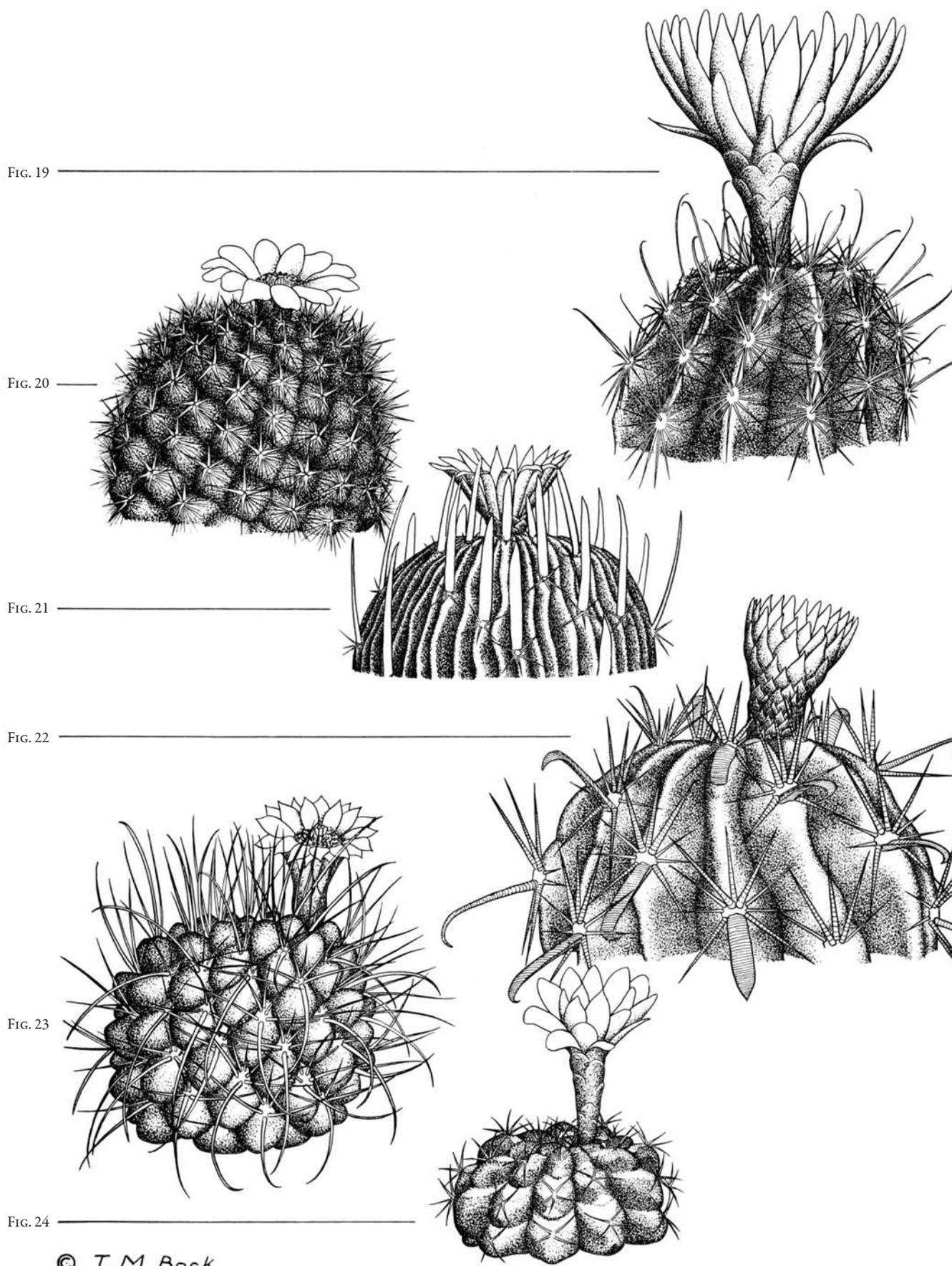
SUB-TRIBE 4. ECHINOCACTANAE—*continued*

KEY TO GENERA

- Axils of flower scales naked (repetition);
 Tube of flower not longer than limb, its scales fringed; central spine
 hooked (Fig. 19) Genus 18. *Hamatocactus*
- DD. Flowers mostly campanulate, at least not long and slender
 (except *Gymnocalycium*)
- E. Rootstocks usually as large as the plant; ribs tuberculate (Fig. 20) Genus 19. *Weingartia*
- EE. Rootstocks not as large as plant;
- F. Scales on ovary and flower tube not fringed or lacerated (except
 some *Ferocacti*)
- G. Axils of scales on ovary and fruit naked;
- Ribs continuous, rarely tubercled; flowers with scarcely
 any tube;
- Ribs numerous; much compressed, thin (Fig. 21) . Genus 20. *Stenocactus*
- Ribs less numerous; thicker (Fig. 22) Genus 21. *Ferocactus*
- Ribs usually broad, tubercled; flowers with a definite tube;
- Areoles borne at base of flattened tubercles (Fig. 23) . Genus 22. *Neowerdermannia*
- Areoles borne on the tips of flattened tubercles (Fig. 24) Genus 23. *Gymnocalycium*

ILLUSTRATED IN PLATE 15

- FIG. 19. *Hamatocactus setispinus*
 FIG. 20. *Weingartia Cumingii*
 FIG. 21. *Stenocactus lamellosus*
 FIG. 22. *Ferocactus latispinus*
 FIG. 23. *Neowerdermannia Vorwerkii*
 FIG. 24. *Gymnocalycium Mihanovichii*



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PLATE 15 (three-fourths size)

SUB-TRIBE 4. ECHINOCACTANAE-continued

KEY TO GENERA

- GG. Axils of scales on ovary hairy, woolly or setose;
- H. Ovary scales many, their axils woolly;
- Axils of scales on flower tube neither bristly nor spiny;
- Fruit permanently woolly, nearly dry, dehiscent by a basal pore
 (Fig. 25) Genus 24. *Echinocactus*
- Fruit less woolly; bursting irregularly (Fig. 26). Genus 25. *Homalocephala*
- Fruit woolly; plant bodies shell-like (Fig. 27) Genus 26. *Astrophytum*
- Axils of scales on flower tube usually bristly or spiny as well as woolly;
- Top of fruit spinose; seeds pitted (Fig. 28) Genus 27. *Eriosyce*

ILLUSTRATED IN PLATE 16

FIG. 25. *Echinocactus horizionthalonius*FIG. 26. *Homalocephala texensis*FIG. 27. *Astrophytum asterias*FIG. 28. *Eriosyce ceratistes*

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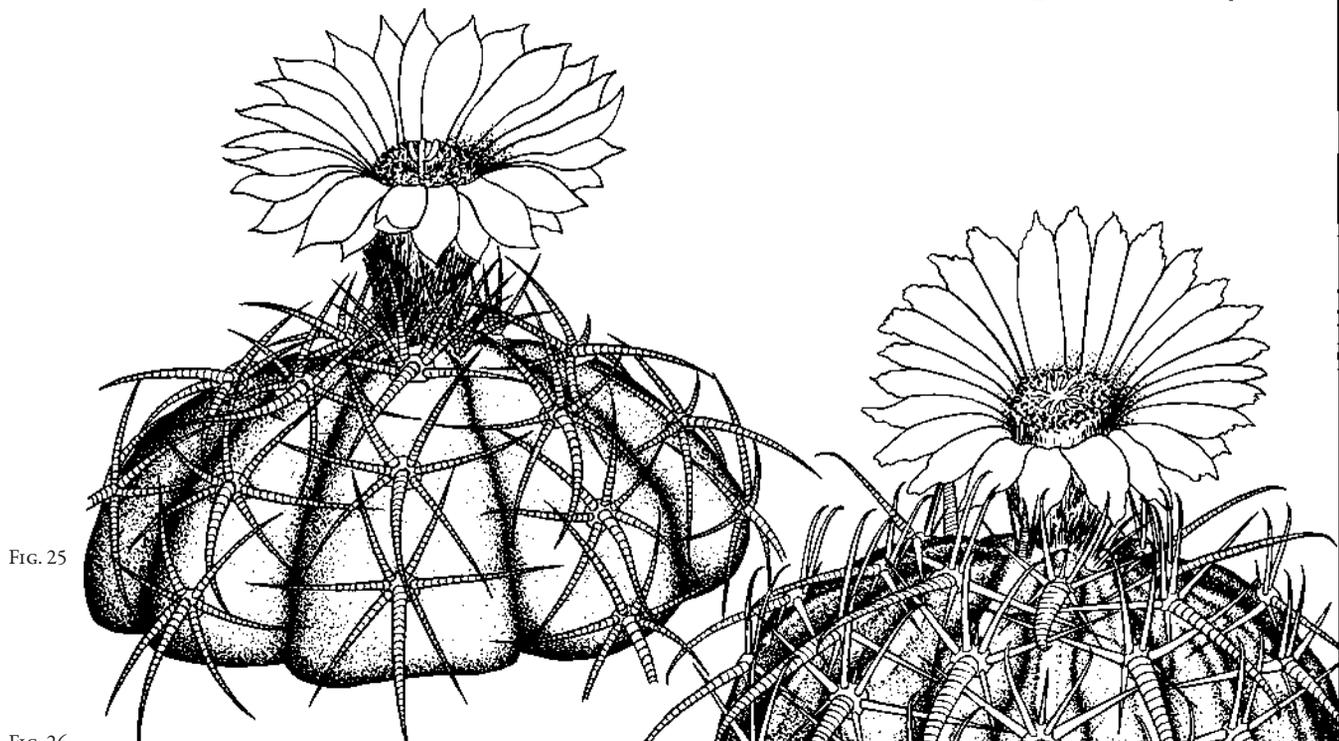


FIG. 25

FIG. 26

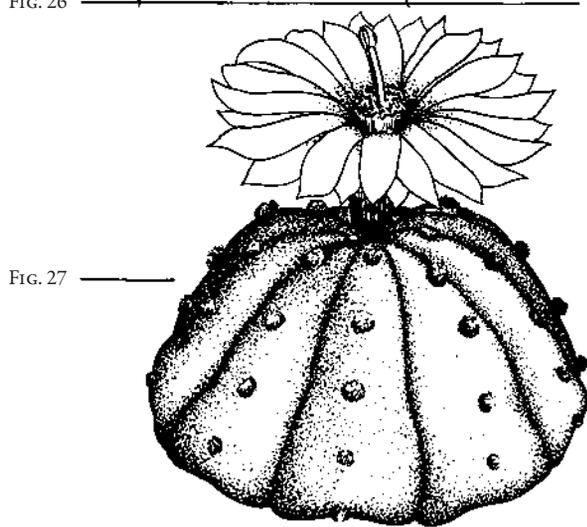


FIG. 27

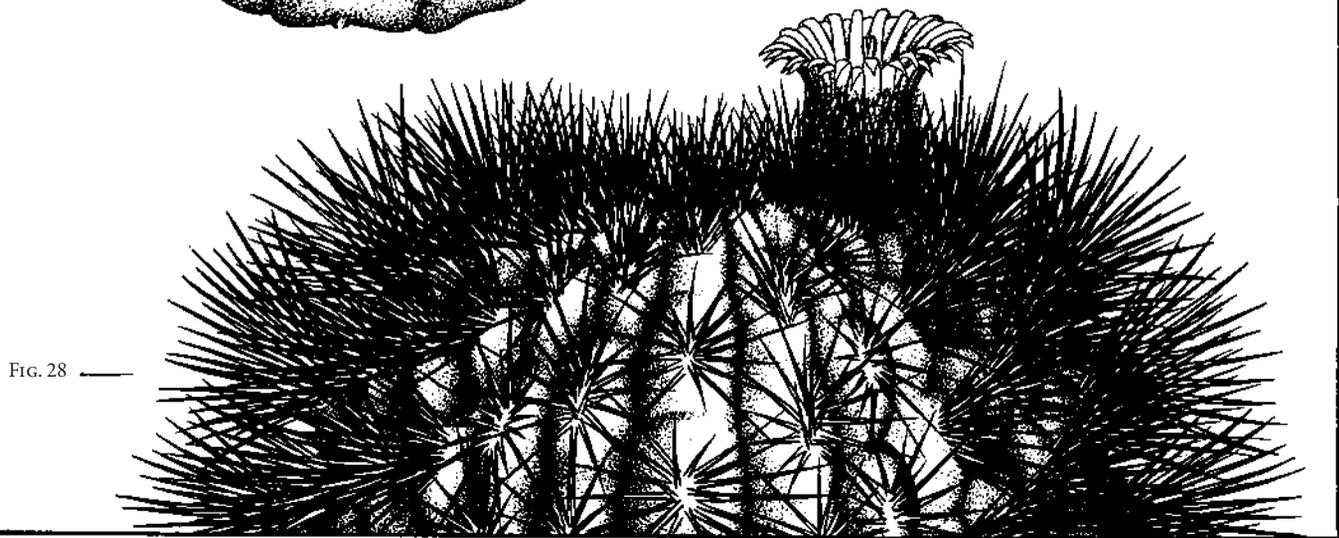


FIG. 28

PLATE 16 (three-fourths size)

SUB-TRIBE 4. ECHINOCACTANAE—*continued*

KEY TO GENERA

- Axils of scales on flower tube usually bristly or spiny as well as woolly; (repetition)
- Top of fruit not spinose; seeds not pitted;
- Ribs notched (Fig. 29) Genus 28. *Pyrrhocactus*
- Ribs not notched;
- Seeds not shell like; plants large;
- Spines straight or rarely curved;
- Fruit a soft, red berry (Fig. 30) Genus 29. *Malacocarpus*
- Fruit dry and woolly (Fig. 31) Genus 30. *Notocactus*
- Spines acicular, one of the centrals sometimes hooked; seed minute
(Fig. 32) Genus 31. *Parodia*
- Seeds shell like; plants small (Fig. 33) Genus 32. *Frailea*

ILLUSTRATED IN PLATE 17

- FIG. 29. *Pyrrhocactus* sp.
 FIG. 30. *Malacocarpus Arechavaletai*
 FIG. 31. *Notocactus Ottonis*
 FIG. 32. *Parodia setifer*
 FIG. 33. *Frailea Grabliana*

FIG. 29

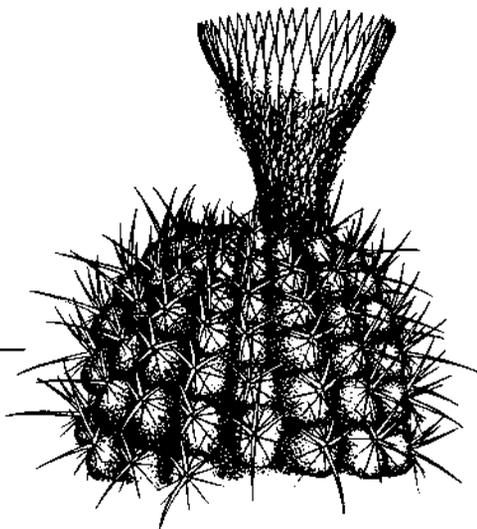


FIG. 30

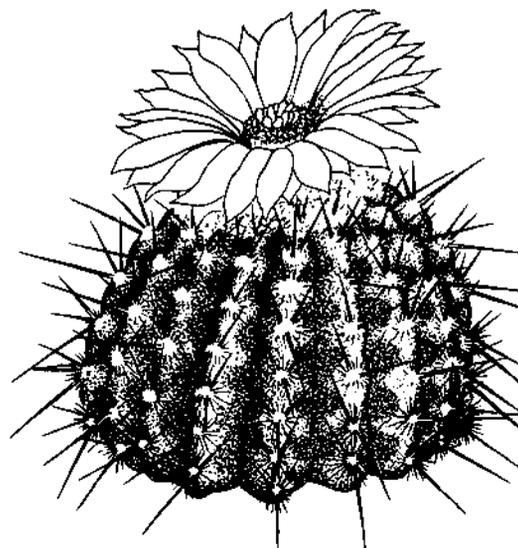


FIG. 31

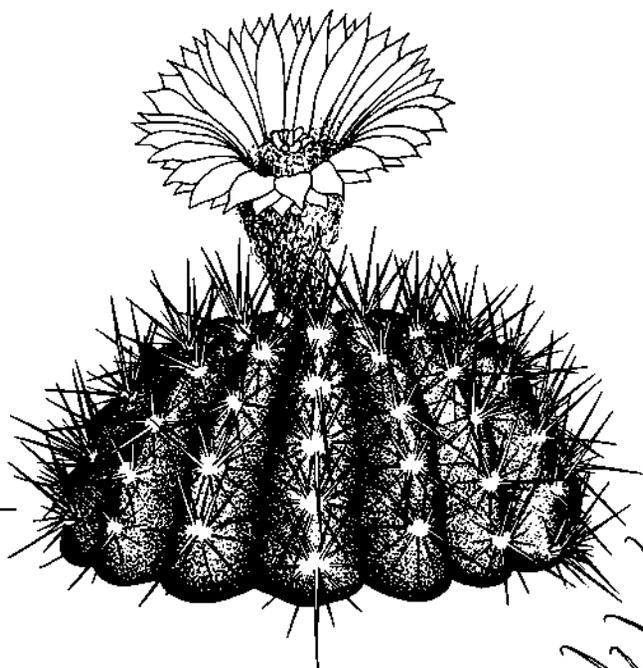


FIG. 32

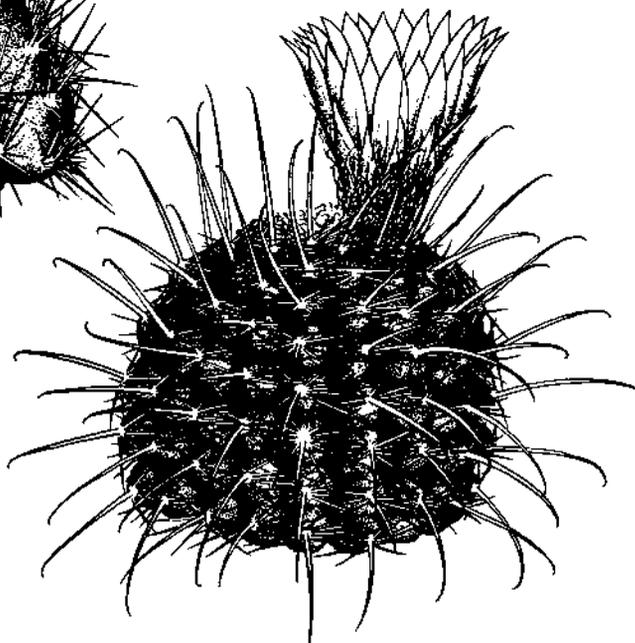
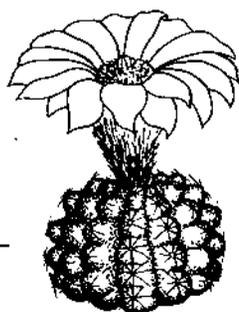


FIG. 33



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PLATE 17 (three-fourths size)

SUB-TRIBE 4. ECHINOCACTANAE—*continued*

KEY TO GENERA

- HH. Ovary scales few, their axils with tufts of short hairs; Fruit a berry; spines all straight (Fig. 34). Genus 33. *Mila*
 Fruit dry, dehiscent by a basal pore; some of the spines hooked (Fig. 35). Genus 34. *Sclerocactus*
- FF. Scales of the ovary and tube fringed, lacerated; plant small; flowers nearly rotate (Fig. 36) Genus 35. *Utahia*
- Plants not keyed:
- A genus between *Ariocarpus* and *Leuchtenbergia* (Fig. 37) Genus 36. *Neogomesia*
 An aberrant genus from South America (Fig. 38) Genus 37. *Blossfeldia*

ILLUSTRATED IN PLATE 18

- FIG. 34. *Mila Nealeana*
 FIG. 35. *Sclerocactus polyancistrus*
 FIG. 36. *Utahia Sileri*
 FIG. 37. *Neogomesia agavioides*
 FIG. 38. *Blossfeldia liliputana*

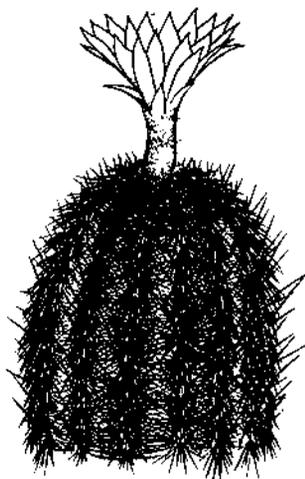


FIG. 34

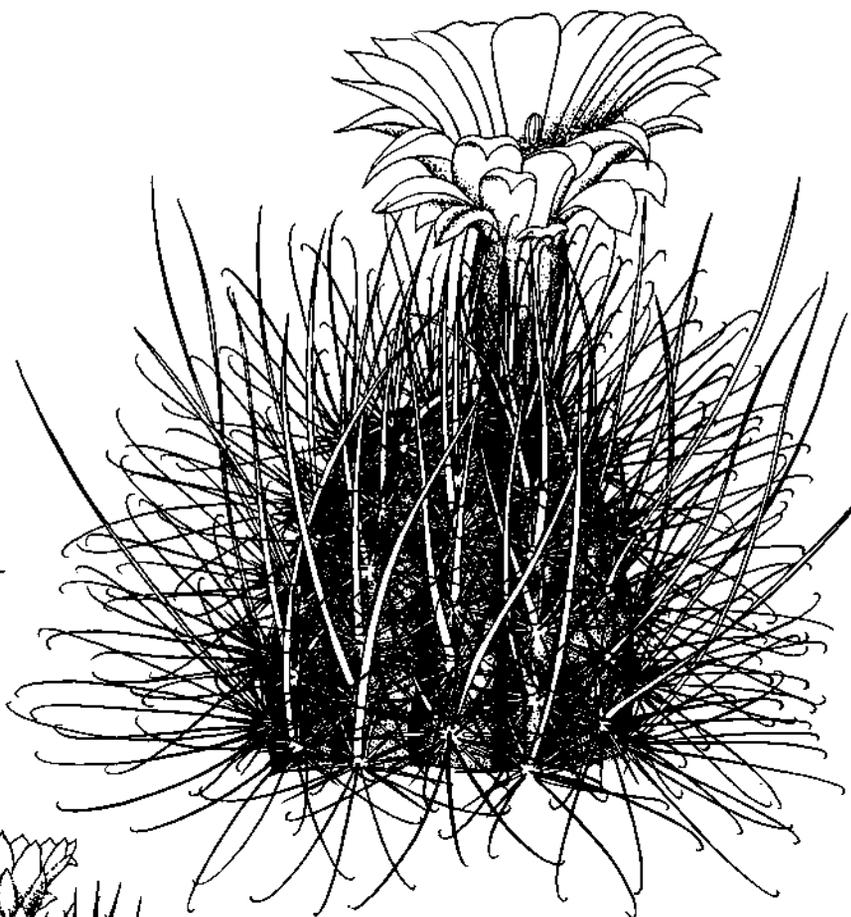


FIG. 35

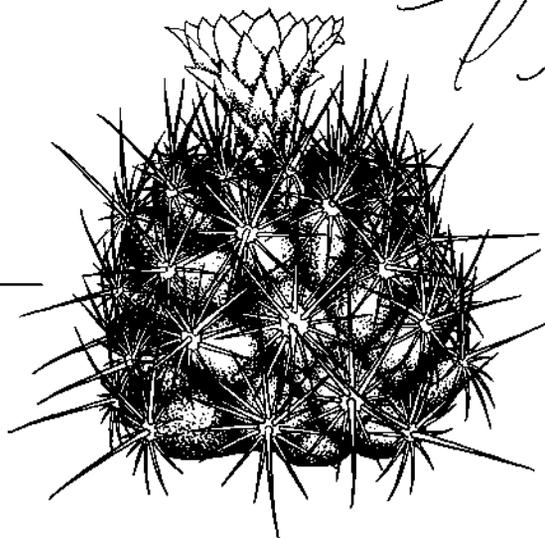


FIG. 36

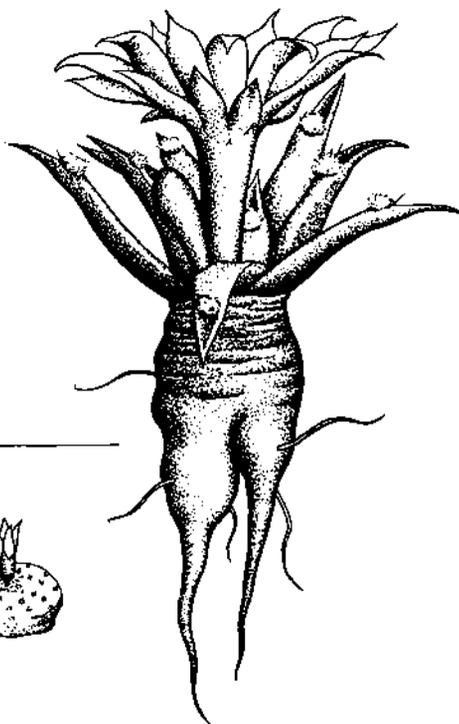


FIG. 37



FIG. 33

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SUB-TRIBE 5. CACTANAE

KEY TO GENERA

- A. Flowers large, white or rose, the limb of many segments; night blooming (Fig. 1) Genus 1. *Discocactus*
 AA. Flowers small, rose or pinkish, the limb of few or several segments, day blooming (Fig. 2) Genus 2. *Melocactus*

ILLUSTRATED IN PLATE 19

FIG. 1. *Discocactus alteolens*FIG. 2. *Melocactus intortus*

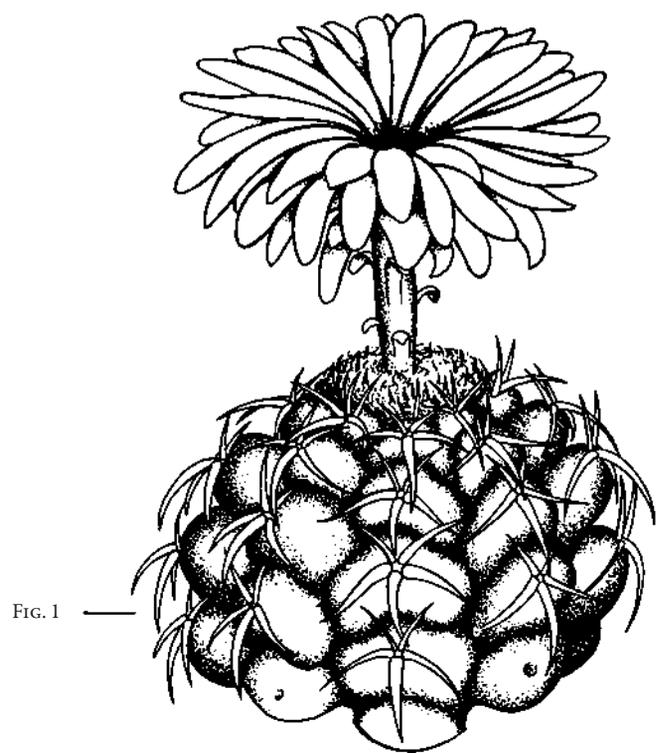


FIG. 1

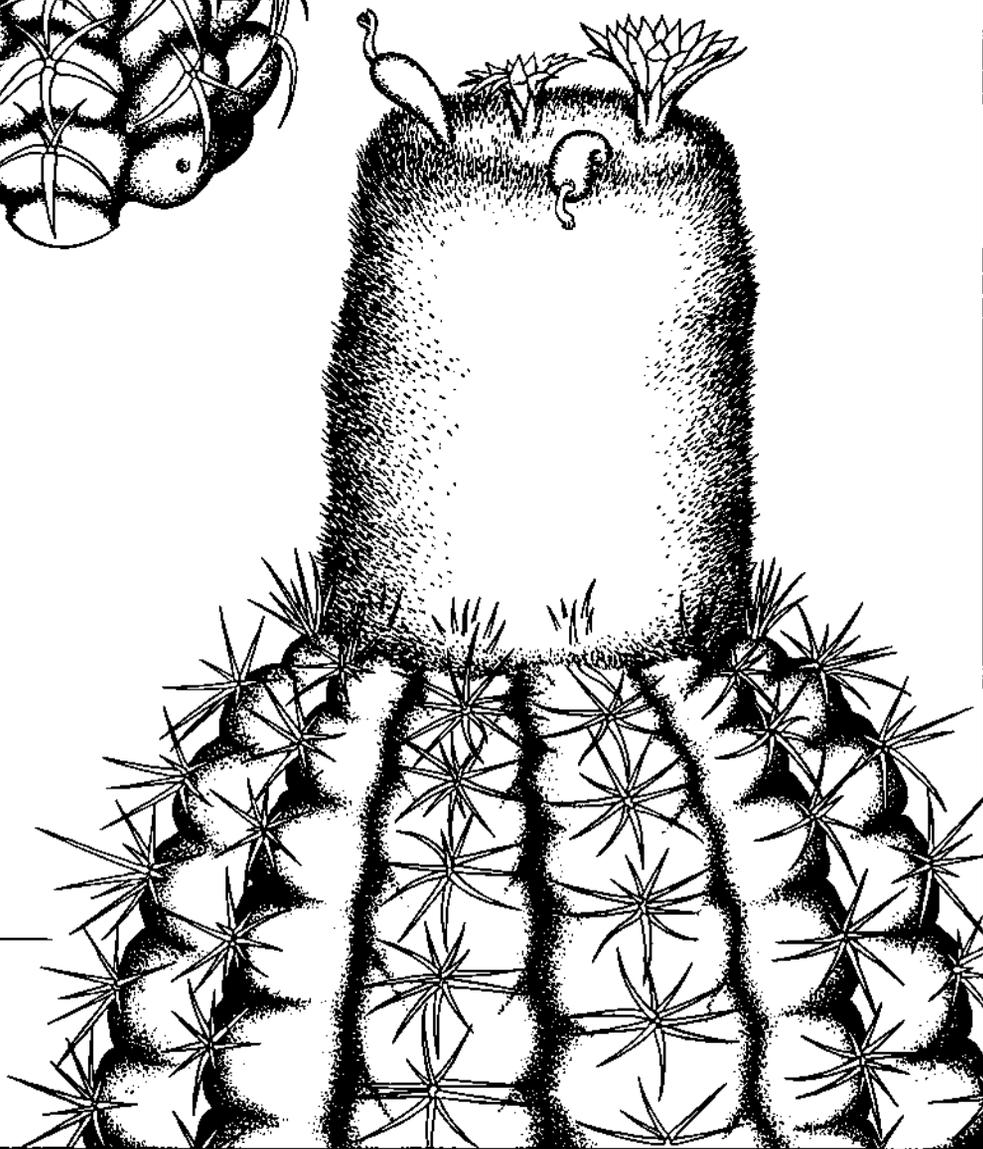


FIG. 2

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PLATE 19 (three-fourths size)

SUB-TRIBE 6. CORYPHANTHANAЕ

KEY TO GENERA

- A. Ovary more or less scaly;
 - B. Flower bell shaped with, short tube;
 - C. Some of the spines hooked (Fig. 1) Genus 1. *Ancistrocactus*
 - CC. Spines rarely hooked; tubercles grooved;
 - Fruit juicy, nearly naked (Fig. 2) Genus 2. *Neolloydia*
 - Fruit dry, scaly, dehiscing by a basal pore;
 - Hilum of seed basal (Fig. 3) Genus 3. *Thelocactus*
 - Hilum of seed ventral (Fig. 4) Genus 4. *Echinomastus*
 - BB. Flower tube long, scaly; tubercles not grooved (Fig. 5) Genus 5. *Mamillopsis*

ILLUSTRATED IN PLATE 20

FIG. 1. *Ancistrocactus Scheeri*FIG. 2. *Neolloydia texensis*FIG. 3. *Thelocactus tulensis*FIG. 4. *Echinomastus erectocentrus*FIG. 5. *Mamillopsis senilis*

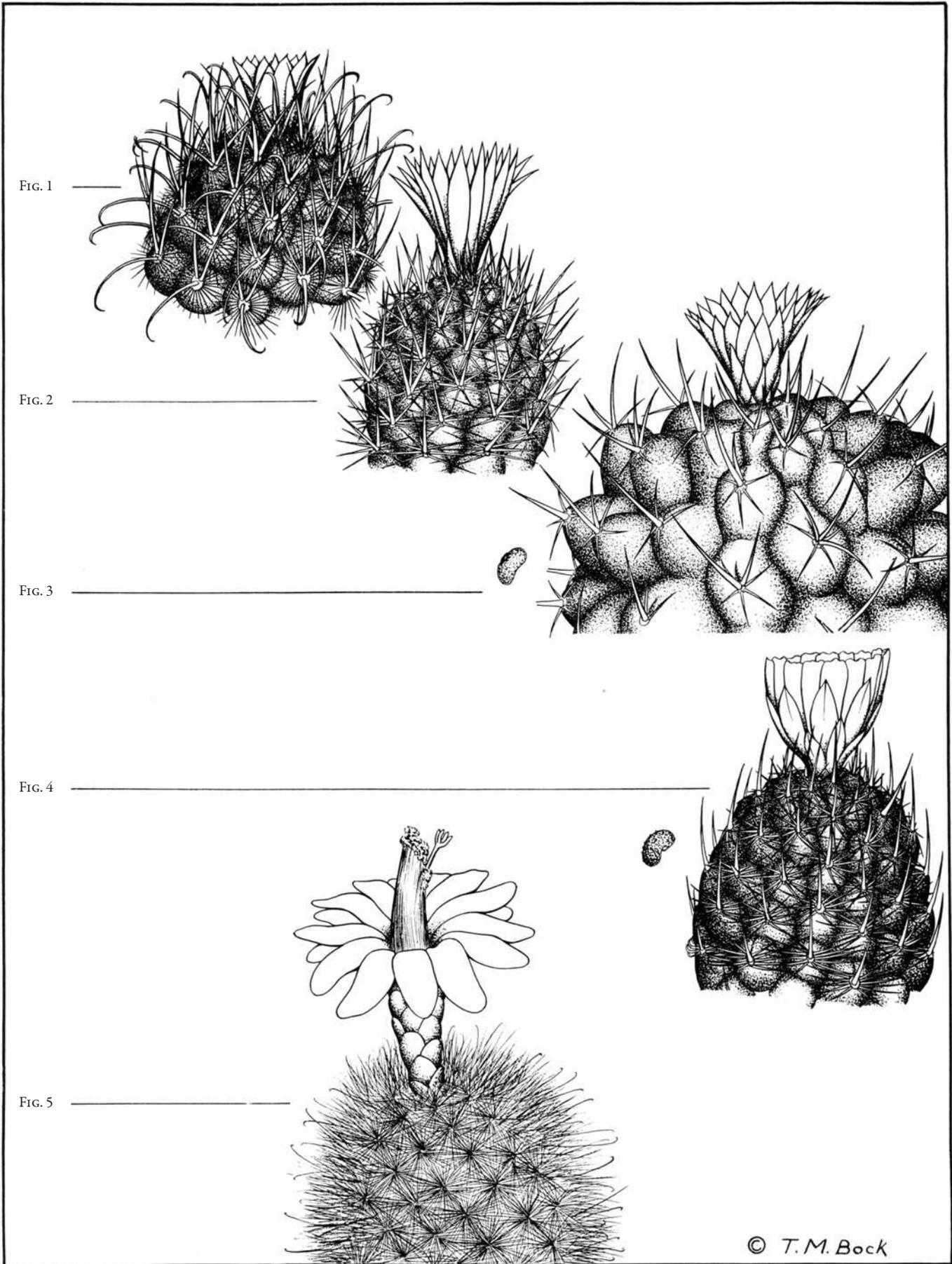


PLATE 20 (three-fourths size)

SUB-TRIBE 6. CORYPHANTHANAЕ—*continued*

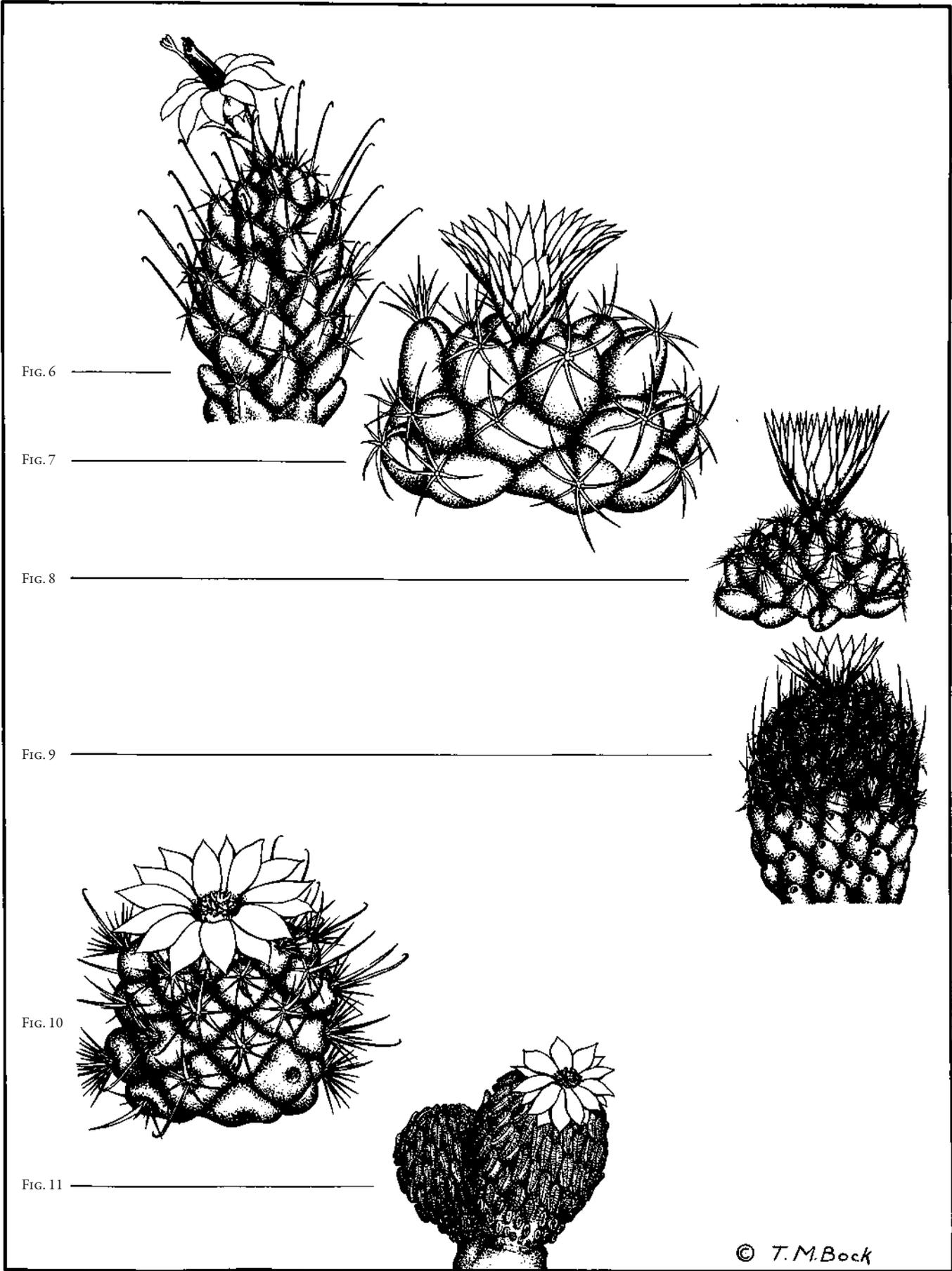
KEY TO GENERA

- AA. Ovary naked or nearly so;
 B. Flowers irregular; tubercles not grooved (Fig. 6) Genus 6. *Cochemiea*
- BB. Flowers regular;
 C. Flowers central, borne in the axils of young tubercles; large (except *Escobaria*);
 D. Tubercles grooved on upper side; flower borne at the base of groove;
 Seeds mostly light brown; fruit greenish, ripening slowly (Fig. 7) Genus 7. *Coryphantha*
 Seeds black to dark brown; fruit red, maturing rapidly;
 Tubercles long, not numerous; aril of seed large (Fig. 8) Genus 8. *Neobesseya*
 Tubercles short, numerous, persisting as woody knobs; aril of seed small (Fig. 9) Genus 9. *Escobaria*
- DD. Tubercles not grooved above;
 Tubercles fleshy; spines acicular (Fig. 10) Genus 10. *Bartschella**
 Tubercles woody; spines pectinate (Fig. 11) Genus 11. *Peleciphora*

ILLUSTRATED IN PLATE 21

- FIG. 6. *Cochemiea Poselgeri*
 FIG. 7. *Coryphantha bumamma*
 FIG. 8. *Neobesseya missouriensis*
 FIG. 9. *Escobaria tuberculosa*
 FIG. 10. *Mammillaria Schumannii*
 FIG. 11. *Peleciphora aselliformis*

* This genus is returned to *Mammillaria*. see text.



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PLATE 21 (three-fourths size)

SUB-TRIBE 6. CORYPHANTHANAЕ—*continued*

KEY TO GENERA

- CC. Flowers lateral, borne in axils of old tubercles, these never grooved above;
 Seed with a large, corky aril (Fig. 12). Genus 12. *Phellosperma**
- Seed without a corky aril;
 Flower large with an elongated tube; tubercles long, flabby (Fig. 13) . . . Genus 13. *Dolichothele**
- Flower fleshy at base; ovary protruding (Fig. 14) Genus 14. *Porfiria*
- Flower small, bell-shaped; tubercles not flabby;
 Hilum of seeds large; tubercles lactiferous; spines pectinate (Fig. 15) . Genus 15. *Solisia*
- Hilum of seeds small; tubercles sometimes lactiferous, but not in species
 with black seeds; spines not pectinate (Fig. 16) Genus 16. *Mammillaria*

ILLUSTRATED IN PLATE 22

- FIG. 12. *Mammillaria phellosperma*
 FIG. 13. *Mammillaria longimamma*
 FIG. 14. *Porfiria Schwartzii*
 FIG. 15. *Solisia pectinata*
 FIG. 16. *Mammillaria compressa*

* These genera are returned to *Mammillaria*, see text.

FIG. 12



FIG. 13

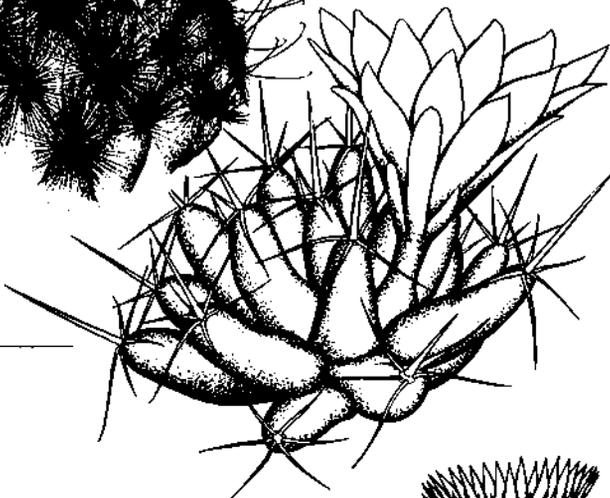


FIG. 14

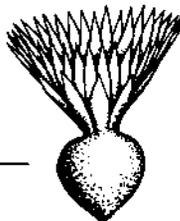


FIG. 15

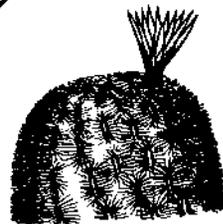
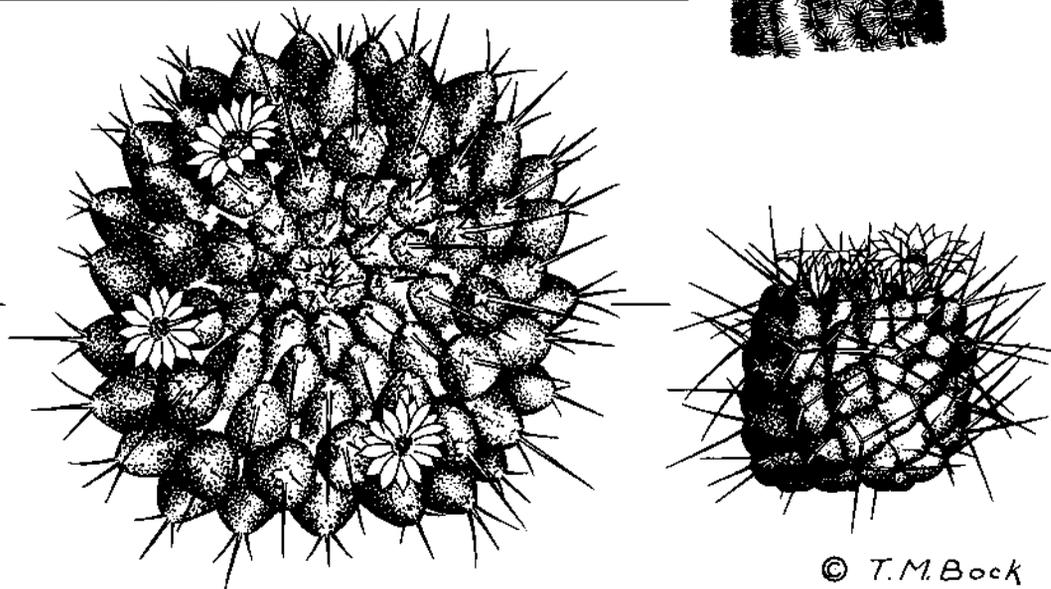


FIG. 16



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PLATE 22 (three-fourths size)

SUB-TRIBE 7. EPIPHYLLANAE

KEY TO GENERA

- A. Plants branching dichotomously;
 Flower irregular;
 Joints thin and leaf-like with toothed margins; areoles all marginal
 (Fig. 1) Genus 1. *Zygocactus*
 Joints thick, without teeth, bearing areoles all around (Fig. 2). . . . Genus 2. *Epiphyllanthus*
 Flower regular; joints thin (Fig. 3). Genus 3. *Schlumbergera*
- AA. Plants branching irregularly;
 B. Perianth segments spreading or reflexed; flowers mostly large;
 Tube of flower longer than limb (Fig. 4) Genus 4. *Epiphyllum*

ILLUSTRATED IN PLATE 23

- FIG. 1. *Zygocactus truncatus*
 FIG. 2. *Epiphyllanthus obovatus*
 FIG. 3. *Schlumbergera Gaertneri*
 FIG. 4. *Epiphyllum Darrahii*

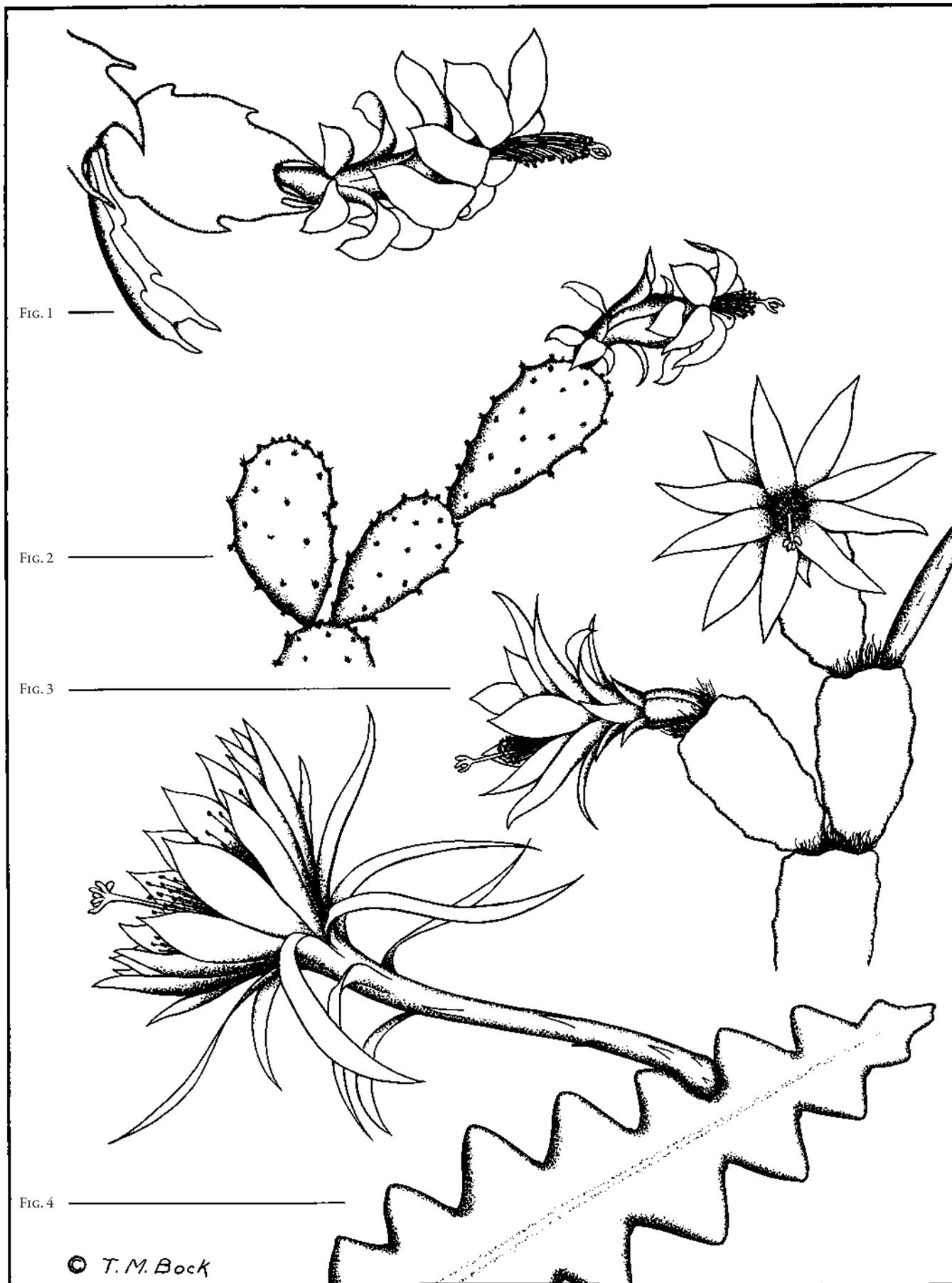


PLATE 23 (three-fourths size)

SUB-TRIBE 7. EPIPHYLLANAE—*continued*

KEY TO GENERA

- Tube of flower not longer than limb;
- Perianth bell-shaped, its segments few;
- Stamens few; flowers small (Fig. 5) Genus 5. *Disocactus*
- Stamens many; flowers large (Fig. 6). Genus 6. *Chiapasia*
- Perianth short-funnelform; its segments many;
- Outer perianth segments short, obtuse or rounded, the inner white
 (Fig. 7) Genus 7. *Eccremocactus*
- Outer perianth segments acute or acuminate, the inner rose or red
 (Fig. 8) Genus 8. *Nopalxochia*
- BB. Perianth segments erect, flowers small (Fig. 9) Genus 9. *Wittia*

ILLUSTRATED IN PLATE 24

FIG. 5. *Disocactus Eichlamii*FIG. 6. *Chiapasia Nelsonii*FIG. 7. *Eccremocactus Bradei*FIG. 8. *Nopalxochia phyllanthoides*FIG. 9. *Wittia panamensis*



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PLATE 24 (three-fourths size)

SUB-TRIBE 8. RHIPSALIDANAE

KEY TO GENERA

Flowers with a short tube;

Joints rounded (Fig. 1) Genus 1. *Erythrorhipsis*

Joints flattened, ribbed or angled;

Joints and flowers terminal (Fig. 2) Genus 2. *Rhipsalidopsis*

Joints and flowers normally lateral;

Joints with spiny areoles; ovary and fruit with areoles subtended by scales;

Joints ribbed; fruit areoles spiny (Fig. 3) Genus 3. *Pfeiffera*

Joints flattened or 3 winged; fruit areoles not spiny (Fig. 4) Genus 4. *Acanthorhipsis*

Joints not spiny; fruit mostly without areoles;

Upper joints normally flattened; areoles not pilose (Fig. 5) Genus 5. *Pseudorhipsis*

Upper joints flattened or 3 angled; areoles long pilose (Fig. 6) Genus 6. *Lepismium*

Flowers without tube:

Petals erect; ends of joints unlike; flowers and branches always terminal (Fig. 7) Genus 7. *Hariota*

Petals usually widely spreading; ends of same joint usually similar; flowers and branches lateral or terminal (Fig. 8). Genus 8. *Rhipsis*

ILLUSTRATED IN PLATE 25

FIG. 1. *Erythrorhipsis pilocarpa*

FIG. 2. *Rhipsalidopsis rosea*

FIG. 3. *Pfeiffera ianthothele*

FIG. 4. *Acanthorhipsis micrantha*

FIG. 5. *Pseudorhipsis alata*

FIG. 6. *Lepismium cruciforme*

FIG. 7. *Hariota salicornioides*

FIG. 8. *Rhipsis heteroclada*

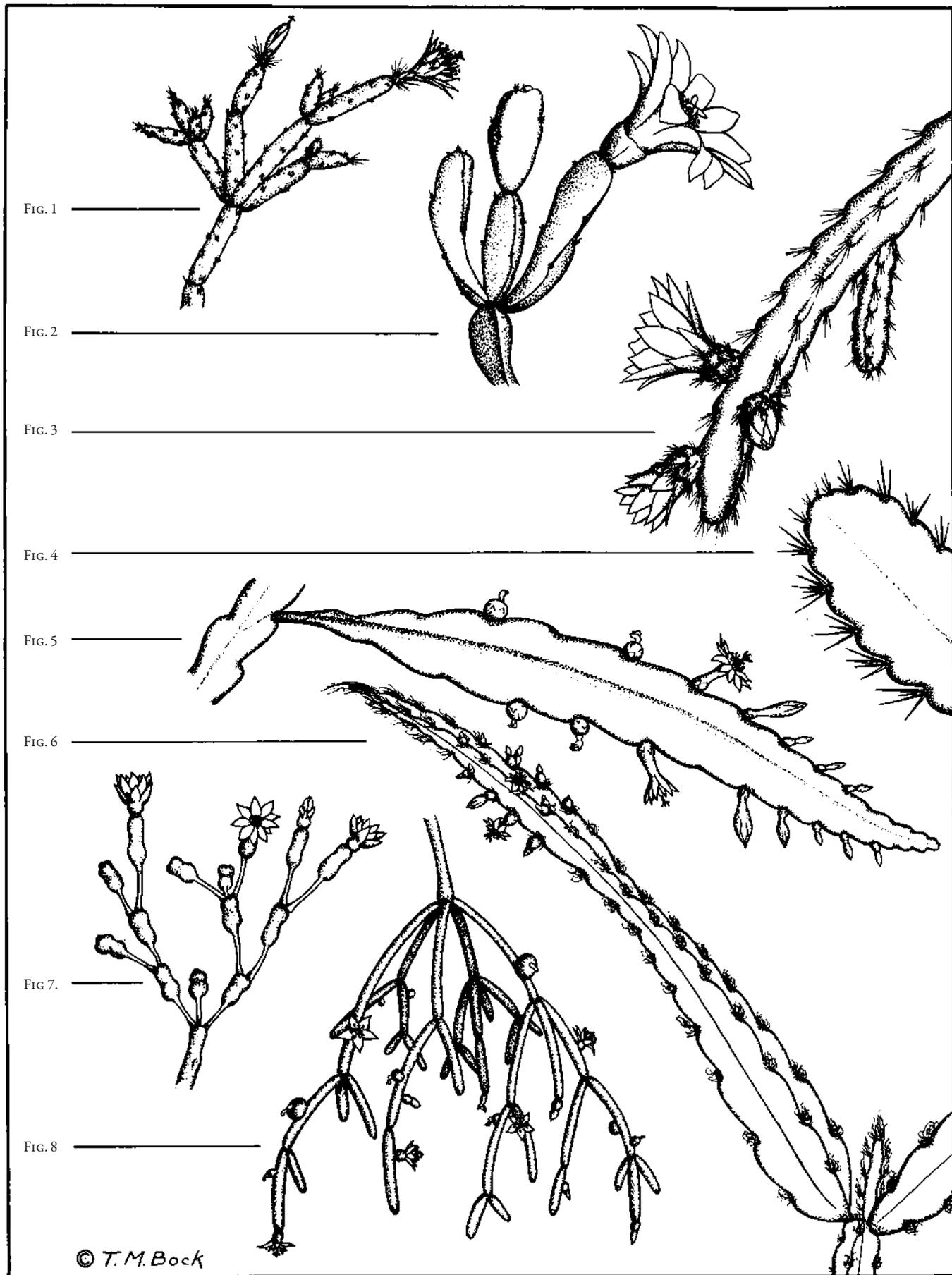


PLATE 25 (three-fourths size)



Opuntias are part of the Coat of Arms of Mexico.

Tribe I. PERESKIEAE

Genus 1. **Pereskia** (Plumier) Miller, 1754. Pl. 2: Fig 1.

Syn: *Rhodocactus* Knuth

The genus *Pereskia* was first given its name by C. Plumier in 1703, but was merged by Linnaeus into the genus *Cactus* in 1733. In 1754, Philip Miller re-established the generic name of *Pereskia*. Thus when the names of the authors



FIG. 3. *Pereskia grandifolia* Haw. x 0.8. Photo by John Poindexter.

of the genus or plant are shown [*Pereskia* (Plumier) Miller], there is no doubt as to the genus or plant under discussion.

In this genus the plants may be trees, shrubs, or vines having a resemblance to roses. The leaves are not greatly thickened, and are usually glossy and protected by spines arranged in pairs or clusters. The stems and branches covered with a bark might easily be mistaken for stems of roses, were it not for the spines instead of thorns (rose thorns clasp the stem, whereas spines always grow from an areole). The flowers have an indefinite number of stamens and petals, and do not form a tube.

The sub-genus *Eupereskia* Sch. represents the more primitive forms in which the ovary of the flowers is a mere hollow in the base of the pistil

(Pl. 2: Fig. 3 and 4), while in the sub-genus *Rhodocactus* Berger, the ovary is a true chamber (Pl. 2: Fig. 5). Plants assigned to either sub-genus are known as *Pereskias*. Count Knuth has raised the sub-genus *Rhodocactus* to generic rank, but no other of the recent writers agree with this radical departure, and we feel that convenience is best served by retaining the genus intact and using the sub-generic division to show the physiological distinctions.

Habitat: While of wide geographic distribution, members of the genus *Pereskia* are found growing wild only in the tropics. The species are native in the West Indies, Mexico, Central America and South America.

Culture: As tropical plants, they will stand but little cold, and therefore should be grown as hothouse plants, only. Very roomy pots are required and these should be filled with a loose, friable mixture of leaf-mold, top soil, and sand * Temperature should be kept well above the freezing point; 50 degrees is recommended as minimum, and water can be freely supplied in growing seasons. They propagate well from cuttings or from seed.

Desirability: As they are necessarily greenhouse plants, except in favored districts like



FIG. 4. *Pereskia guamacho* Weber, showing a tree form. Photo by F. M. Arnoldo, Curaçao, Dutch West Indies.

Southern California, the Rio Grande valley of Texas, etc., they would be desirable only to growers having these facilities, Eastern growers have obtained flowers from plants several years old. They repay the necessary attention by the unusually showy and profuse flowers of white, pink and orchid.

Uses: In the tropics they are used as ornamentals, and frequently are planted as hedges (*Pereskia aculeata* illus. Br. & R., Vol. 1: page 7). They are considered as good grafting stock by many fanciers, especially for Christmas Cactus, Orchid Cactus, etc. The edible fruits are

called Barbados Gooseberries in the West Indies.

Desirable species: Of the 18 species, *Pereskia aculeata* Mil., *P. grandifolia* Haw., and *P. sacharosa* Greis. are the most desirable. *P. aculeata*, however, will flower only under the most favorable conditions.

Genus 2. *Maihuenia* Philippi, 1883. Pl. 2: Figs. 6 and 7.

A genus of low-growing plants, frequently forming dense mats of vegetation. The short cylindrical stems bear spines from the areoles but no bristles (glochids). Small, awl-shaped, persistent leaves also arise from the areoles. The flowers come from areoles at the tip of the stems. The flowers are large and showy, yellow or red. The ovary is a mere hollow in the base of the pistil as in the sub-genus *Eupereskia* of the genus *Pereskia*.

Habitat: Sandy sections of Chile and Argentina.

Culture: Very sandy soil is a requisite for *Maihuenia*, and good success has been obtained with a mixture of two parts of sharp sand to one part of decomposed manure. A sunny location is desirable, and lots of water can be given in growing season.

Desirability: The bright flowers freely pro-



FIG. 5. *Maihuenia Poeppigii* (Otto) Weber x 0.4. Photo by Graham Heid of a plant received from Chile.

duced from the low mats of green leaves make species of this genus very decorative.

Desirable species: *Maihuenia Poeppigii* is obtainable.

Tribe II. OPUNTIEAE

Genus 1. *Pereskiopsis* Britton and Rose, 1907.

The name "Pereskiopsis" is from the Greek, meaning Pereskia-like. These trees and shrubs are similar in habit to *Pereskia*, but usually have thickened leaves. The old trunk becomes woody and covered with bark. The spine cushions are circular in shape and usually bear spines, also hairs, wool, and glochids. The stemless flowers are wheel-shaped, the fruit red and juicy, the few seeds bony and covered with matted hairs.

They can be distinguished from *Pereskia* by their thickened leaves (Pl. 3: Fig. 1), stemless flowers (except *P. opuntiaeflora*), and hairy seeds. About eleven species are known.

Habitat: Tropical Mexico and Guatemala.

Culture: While *Pereskiopsis* will stand slightly more cold than *Pereskia*, they are still tropical and should be attempted only in greenhouses. Loose soil of equal parts leaf-mold, sand and top

soil, and large pots will produce best results. Water freely in growing season. Propagate from cuttings or from seeds.

Desirability: *Pereskiopsis* is less desirable than *Pereskia*, being shyer bloomers and less successful as grafting stock. Many species are rare; in fact few species are available to fanciers in the United States.

Uses: In tropical countries used sometimes as hedges for protection. Sometimes used as grafting stock.

Desirable species: *Pereskiopsis Porteri* (Brand.) Br. & R.; and *Pereskiopsis chapistle* (Weber) Br. & R.

RECENT NEW SPECIES SINCE BR. & R.

P. Gatesii Baxter, from Baja California, is similar to *P. Porteri* in general appearance, but the fruit is smaller

and sterile, and reproduction is by vegetative division only. It was described by Baxter in the "Cactus and Succulent Journal," Vol. III: Page 135.

FIG. 6 RIGHT: *Pereskiopsis Porteri* (Brand.) Br. & R. x 0.7.
Photo by Ervin Strong of a plant in his collection.

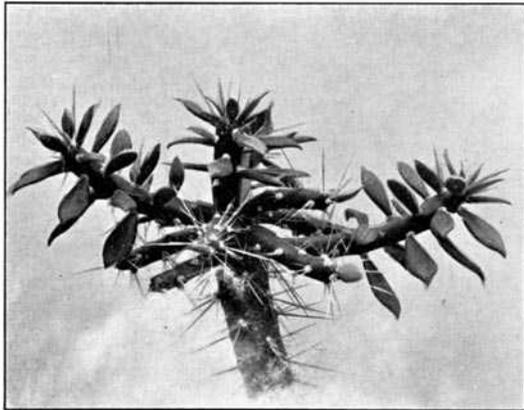


FIG. 7. *Quiabentia chacoensis* Bckbg. x 0.2. Photo by Scott Haselton of a plant in R. W. Kelly's Nursery in Temple City, California.



Genus 2. **Quiabentia** Britton and Rose, 1919.

The type of this genus, *Quiabentia Zehntneri*, was once assigned to *Pereskia*; the large, red, wheel-shaped flower suggests that genus, but the areoles produce glochids. In its broad, thick leaves, the species suggest *Pereskiopsis* but it differs from this genus because it bears flowers from the tips of the branches and because it has smooth seeds.

Habitat: Brazil and Bolivia.

Culture: Glasshouse care is required for species of this genus. The soil must be loose and

rather rich. Water can be freely given in the growing season. Flowers in October.

Desirable species: Only *Quiabentia chacoensis*, Fig. 7, is obtainable in the United States.

RECENT NEW SPECIES SINCE BR. & R.

Q. Pflanzii Vaupel 1923. A tree up to 18 feet high. Flowers pale red.

Q. verticillata Vaupel, 1923. A shrub about 6 feet tall. Flowers pale red.

Q. chacoensis Bckbg., 1935. A very low-growing shrub.

Genus 3. **Pterocactus** K. Schumann, 1897. Pl. 3: Fig. 3.

Species of this genus have tuber-like, often greatly enlarged roots, and very small leaves which soon fall off. In its stems it suggests an *Opuntia* of the cylindrical type, but its flowers come from the ends of the stems and the seeds are white and bear wings, from which characteristic the generic name "Pterocactus" (winged-cactus) is derived.

Habitat: Species of this genus are found from Patagonia to western central Argentina on the plains and mountain slopes.

Culture: The few species known to us grow

very slowly on their own roots but do very well if grafted on *Opuntia* stock. Propagations from cuttings are successful.

Desirability: Except to fanciers who desire a complete representation, there is but little of interest in the species of this genus.

RECENT NEW SPECIES SINCE BR. & R.

P. Valentinii (Speg. 1899), was originally *Opuntia australis* Web. and appeared in Br. & R. under the latter name.

P. tuberosus Br. & R. var. *decipiens* Gürke, comb. nova. Marshall, has taller and thicker stems and larger flowers.

Genus 4. **Nopalea** Salm-Dyck, 1820. Pl. 3: Fig. 4.

Tree-like plants with cylindrical trunks and flattened stems and branches which are fleshy and often narrow, somewhat resembling some species of *Opuntia*. The flowers, while showy, red or pink, do not open wheel-like as in *Opuntia*. The erect petals remain at all times closely surrounding the stamens. This peculiar flower separates the genus from *Opuntia*. The name "Nopalea" is from the Mexican common name "nopal". In 1868 plantations or nopalaries raised the cochineal insect on these Nopaleas and millions of pounds were sold to the dye industries for millions of dollars each year.

Habitat: The species are natives of Mexico and Guatemala but have been largely introduced into the West Indies and are cultivated generally throughout the warmer parts of the world.

Culture: Plants of this genus have stood temperatures as low as 30 degrees F. when dry, but should be kept above freezing point for best results. They thrive well out of doors where the weather permits, and are easily pleased as to soils, asking only a porous, well-drained location with a reasonable degree of sunshine. Water rather sparingly. In hothouse cultivation keep on the dry side. Not easily flowered in small indoor gardens, but with plenty of sunshine and

glasshouse heat, flowers can be obtained. Propagation by cuttings is very successful and seedlings grow rapidly.

Desirability: In beauty of form and flower and especially in number of mid-summer flowers, many species of this genus make a real addition to a cactus collection. They grow to rather large, tree-like plants, 6 to 10 feet tall, and may require pruning to keep within bounds,

Uses: As ornamentals, Nopaleas have obtained a high standing. The fruits are edible and have an extensive sale in markets in Mexico and elsewhere. One species, *N. cochenillifera* (Linn.) Salm-Dyck, is so called because on it were raised the cochineal insects from which dye was made before the introduction of aniline dyes. In Mexico, medicines are prepared from Nopaleas. Since lipsticks have become so popular, the cochineal insects have again become commercially valuable as a harmless dye in the coloring of cosmetics.

Desirable species: *Nopalea dejecta* Salm-Dyck, *N. cochenillifera* Salm-Dyck, *N. Auberi* Salm-Dyck, and *N. guatemalensis* Rose, are quite plentiful. All of the eight species in this genus are desirable additions to collections

Genus 5. **Tacinga** Britton and Rose, 1919. Pl. 3: Fig. 5.

This genus has but one species, *Tacinga funalis*, and this is very rare in collections. It is intermediate between *Nopalea* and *Opuntia* and its name is an anagram of "catinga" a Brazilian common name for the thorn bush desert region in Bahia, Brazil, from which it comes.

It is distinguished by the peculiarly recurved

petals of the flowers and the presence of one or more rows of hairs between the petals and the stamens as is well shown in the accompanying illustration.

Illustration: Br. & R., Vol. 1: pg, 39, shows the habit of this plant. Our Pl. 3: Fig. 5, shows *T. funalis*.

Genus 6. **Maihueniopsis** Spegazzini, 1924. Pl.3: Fig. 8.

The generic name means "resembling *Maihuenia*." It is accepted as a separate genus here because it has glochids, while *Maihuenia* has none. This monotypic genus comprises low-growing, clustered plants which often form small, dense mounds; the small, cylindric leaves are persistent (remaining attached) and the spine cushions are filled with white wool and bear bristles (glochids) and one spine. The flowers are comparatively large, white or yellow-

ish-white, usually from the tip of stems, and are without tubes. The fruit is usually juicy and bears small leaves which persist.

Habitat: The high mountains of Argentina.

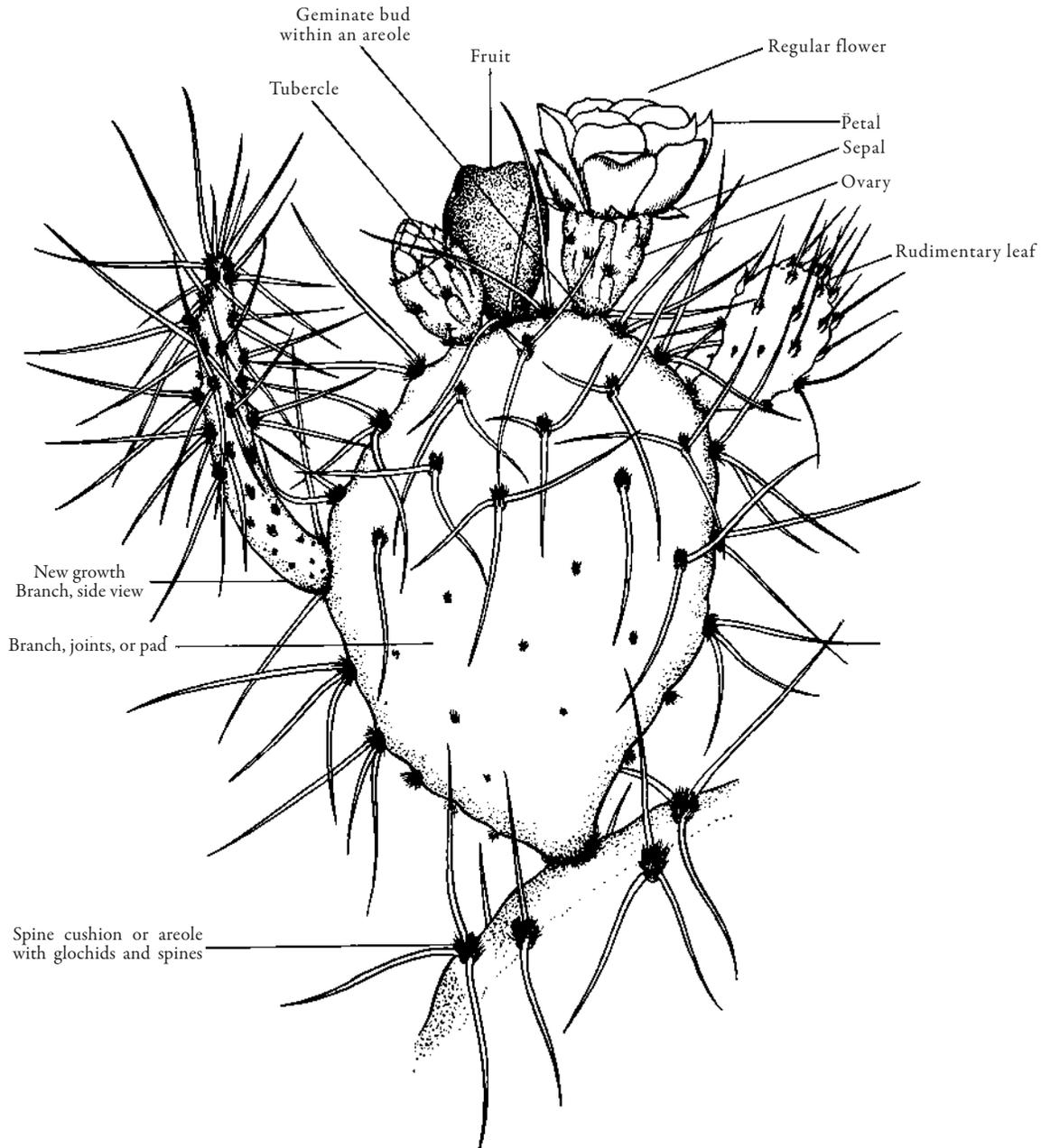
Culture: As for *Opuntia*.

Desirability: The one species, *Maihueniopsis Molfinoi* (Speg.) Werd. & Bckbg., is very rare and would prove a valued find for earnest fanciers.

Genus 7. **Opuntia** (Tournefort) Miller, 1754.

All plants of the genus *Opuntia*, regardless of the sub-genera to which they are assigned, have certain characteristics in common. Roots are fibre-like or tuber-like: the stems are sometimes

wheel-shaped flowers (Pl. 1: Fig. 8) are of various shades and combinations of green, yellow, red, and rarely white. The fruit is a dry or juicy berry, often edible; spiny or smooth, globu-



Typical *Opuntia* growth, showing all important features. Drawing by Thor Methven Bock.

woody; the spine-cushions bear barbed bristles (glochids), hairs, spines, flowers and sometimes glands, the leaves are usually small, awl-shaped and usually fall off as the stem matures. The

lar, egg-shaped, or elliptical. The plants usually are large and fast-growing and require a lot of room in cultivation.

Habitat: From British Columbia in Canada to

the southernmost tip of South America, with one species noted within the Arctic regions. *Opuntia compressa* Salis is the type species which was first named by Linnaeus in 1753 from a plant collected in Virginia which he called *Cactus opuntia*. This species in its various forms is found in the majority of the states in this country and under the American system of classification, was called *Opuntia opuntia*; Britton and Rose also accepted this name.

Culture: With such a wide range of temperatures and altitudes as might be expected from plants from such widely diverse territories, only a few elementary rules can be laid down for their culture. By locating the territory from which the plant originates one can judge its ability to stand cold or heat, but it can be stated as a rule with but few exceptions that Opuntias do not require either rich soil or much water for best results. When in doubt about an Opuntia, withhold water or give water sparingly. A warm sunny location is always safe and some species can stand temperatures well below zero if kept dry. Difficult to flower indoors.

Opuntias are very easy to grow from cuttings or joints and some of the green fruit (*O. monacantha*) will form new plants (Br. & R., Vol. I: pg. 62) if set in damp soil. Opuntia seeds are usually large and also inexpensive, thus making them available for experiments in seed raising.

Uses: The less spiny Platyopuntias, such as the hybrid Mission Cactus, are excellent grafting stock for Christmas Cactus, Epiphyllums, or the globular South American species. The heavier spines are also used in grafting to hold the scion on the stalk. The woody framework of the dried stems of *Cylindropuntias* are used in making canes, furniture, and in some places, to build houses. The fruit, especially of the Platyopuntias, is usually edible and much prized for food and is either eaten raw or is made into jellies, candy or refreshing drinks. After removing the glochids, the young, new pads can be cooked, after slicing into strips, which resemble and have the flavor of string beans. Cattle in Mexico and doubtless other sections can and do live on the young stems of *Cylindropuntias* (Cact. & Succ. Journ. of Amer., Vol. IV: pg. 347) and, after the glochids and spines are burnt off, a few Platyopuntias are used for cattle feed in dry seasons even in the United States.

Opuntias planted as a hedge become impene-

trable, a fact which makes them desirable as fences in certain locations. Platyopuntias are used medicinally for the treatment of burns, as a laxative, and in the treatment of diabetes. The Opuntia forms the motif in many schemes of modern decoration, as it has done since the days of the Aztecs. The coat of arms of Mexico shows an eagle holding a serpent in its mouth and standing on an Opuntia plant (see page 36).

Desirable species: *Opuntia erinacea* Engel. (Grizzly Bear); *O. floccosa* Salm-Dyck, and *O. vestita* Salm-Dyck, (the Old Man Opuntias); *O. clavarioides* Pfeif. (Finger Opuntia); *O. glomerata* Haw. (the paper-spined Opuntia); *O. subulata* Muehl. with its exaggerated, awl-shaped leaves; and *O. microdasys* Lehm, with its golden tufts of those painful glochids, all possess beauty of form and color while most species of the *Tephrocactus* Sub-tribe, have a grotesque habit of growth. A great many Opuntias are available and few of them lack appeal.

The genus *Opuntia*, with more than 340 species, is divided into three sub-genera and these in turn into 45 series. Because of the complexity

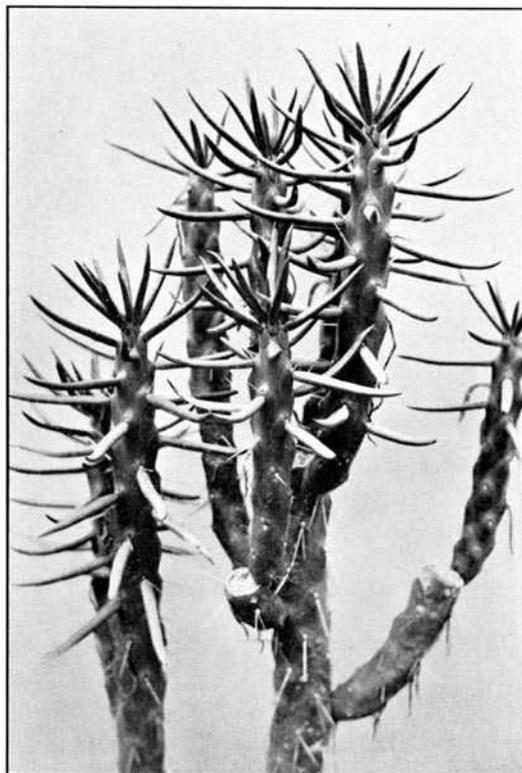


FIG. 8. *Opuntia subulata* (Muhlen.) Engel. x 0.25. Photo by Scott Haselton of a plant growing out of doors in the Nursery of R. W. Kelly, Temple City, California. Example of *Cylindropuntia* in Series 11, SUBULATAE

of this group and the lack of interest in them, we will explain the sub-genera and describe briefly, under the proper Series, the recent new species. Keep in mind that these three sub-genera with their Series are still in Genus 7 of Tribe 2. Beginners may disregard the classification under "Series" to avoid confusion.

Sub-genus I. *Cylindropuntia*

Series 3. *Thurberianae*

Opuntia alamosensis Ortega, 1929. Sinaloa, Mexico. Three to nine feet tall, usually with a definite trunk; branches about ½ inch in diameter, tuberculate when young, cylindrical in age; areoles circular bearing chestnut colored felt; numerous glochids and 4 spines of which one is central, the spines are brown at the base and yellow at the tip and are about ½ inch long; flowers lemon yellow; fruit ovoid, about 1 inch long; yellow or reddish when ripe.

Series 8. *Vestitae*

O. Weingartiana Bckbg., 1935, Bolivia. Up to 1 foot high; branches cylindrical, 4 to 6 inches long and 1 to 1½ inches thick, tuberculate; areoles closely set, large, white; about 3 to 5 spines, red to brown, up to 2 inches long; flower not known; fruit red.

Series 13. *Clavatae*

Opuntia Moelleri Berg., 1929. Coahuila, Mexico. Described as similar to *O. clavata* with shorter, more slender joints, more prominent and elongated tubercles; radial spines numerous, short, bristle-like; central spines 5 or 6, about ½ inch long, thickened at base, ash-colored.

O. dumetorum Berg., 1928. Tamaulipas, Up to 20 inches high; joints cylindrical, about 2 inches long and 1 inch thick; tubercles low; areoles round, white, sometimes with hairs; spines numerous, yellowish-brown, ½ inch long; glochids white.

O. agglomerata Berg., 1929. Coahuila, Low and spreading; joints oval, gray-green, tuberculate; areoles round, white; glochids pale yellow; radial spines 6 or 7, very short, white; central spines 4 to 5, golden, about ½ inch long; flower unknown.

O. Wrightiana Baxter, 1935. Described as *Grusonia Wrightiana* in "California Cactus."

SERIES NOT KNOWN

Opuntia Marenae Parsons, 1936. Kino Bay, Sonora. This interesting species resembles a *Wilcoxia* in habit, roots and slender stems and before flowering was thought to be of that genus. Published in an obscure horticultural monthly and has been overlooked by later writers.

Sub-genus II. *Tephrocactus*

To the second sub-genus, *Tephrocactus*, Fig. 9, are referred about 56 of those short-jointed plants whose joints are almost globe-shaped or very short cylinder-shaped. Count F. M. Knuth has raised the sub-genus *Tephrocactus* to generic rank and has erected the genus *Corynopuntia* for the low-growing species in Series 13, *Clavatae* of *Cylindropuntia*, but his suggestions have not met with favor from contemporary botanists and it seems to serve convenience best to retain the generic name *Opuntia* for all of these plants.



FIG. 9. *Opuntia, Pentlandii* Salm-Dyck x 0.3 Series 4, PENTLANDIANAE in the sub-genus *Tephrocactus*. Photo from Bolivia, courtesy R. W. Kelly.

RECENT NEW SPECIES SINCE BR. & R.

Series 1. **Weberianae**

Opuntia puelchana Cast., Argentina. Arborescent to 3 feet high; joints cylindrical, about 4 inches long and 1 inch in diameter; tubercles prominent; spines about 20, sheathed, 1 to 1½ inch long; flowers yellow.

O. Kuehnrichiana Werd. & Bckbg., 1931, Peru. Joints oval to cylindrical, to 4½ inches long and 2½ inches in diameter, pale green, dotted all over with small white dots; areoles approximate; glochids numerous, yellow; spines 5 to 12, on upper areoles only, ash-colored, spreading, the longest 1½ inches long.

O. Kuehnrichiana var. *applanata* Werd. & Bckbg. joints smaller, flattened, 2 inches or less in diameter; spines 1 to 3, white, acicular.

O. halophila Speg., 1924, Northern Argentina. joints oval or somewhat cylindrical, 1½ to 2½ inches long and about 1 inch in diameter, gray green; areoles small; glochids reddish-brown; spines 9 to 12, grayish, erect like a brush, up to 2 inches long; flowers from sides of young joints about 2 inches long, white to pale pink.

O. strobiliformis Berg., 1929, Argentina. Erect, much branched; joints elongated oval, gray, green; tubercles small but prominent; the joints resembling a pine cone; areoles small; glochids few, gray; spines usually wanting or if present but 1 or 2 short, straight, brown, from upper areoles; flowers not known.

O. albisaetacens Bckbg., 1935, Bolivia. Low plants, the individual joints grayish green, cylindrical, 2 inches long, 1 inch thick; about 10, soft, bristle-like, white,



FIG 10. *Opuntia floccosa* Salm-Dyck x 1. Series 2, FLOCCOSAE in the Sub-genus 2, *Tephrocactus*. Photo by Scott Haselton in Frank R. Mark's gardens in Los Angeles.

spines, about 2 inches long; flower and fruit not mentioned.

Series 2. **Floccosae**

O. haematantha Bckbg. Plant low; joints oval to oval-cylindrical, reddish-green; areoles bearing a few soft, hair-like spines; flowers red.

O. atroviridis Werd. & Bckbg., 1931, Peru. Joints 4 to 12 inches long and 1½ inches in diameter, cylindrical, marked with deep green lines; areoles bear brown glochids, a few hair-like yellow bristles less than an inch long, and about 3 yellow to brown spines about an inch long; flowers yellow.

Series 3. **Glomeratae**

O. Turpinii Lemaire, 1838. This species is recognized by European botanists as distinct from *O. glomerata* Haw., as known here, but they seem to be unable to agree on which name to apply to the varieties in question. Borg describes *O. diademata* Lem., as a larger form of *O. glomerata* with oval joints 2 to 3 or more inches in diameter and *O. Turpinii* as the variety with globose joints 1 to 1½ inches in diameter. Backeberg and Knuth take the opposite view and refer the smaller, globose-jointed variety to *O. glomerata* and the larger, oval-jointed variety to *O. Turpinii*. Convenience is best served by accepting the oldest name, *O. glomerata*, for all of the numerous variations of this very diverse plant and assigning varietal tri-nominals if a more critical division seems desirable.

Series 4. **Pentlandianae**

O. subinermis Bckbg. Low, much branched; oval to sub-globose joints; spines (if present) only on upper areoles. This species is closely related to, if not identical to *O. Pentlandii*.

O. leoncito Werd., 1931, and *O. pseudorauppiana* Backbg., 1935- These species, as described, are so near to *O. atacamensis* Phil., that they can be safely united with that species. All are from the Province of Atacama.

O. riojana Hosseus, 1927, La Rioja, Argentina. Low growing; joints sphaerical to oval, dull dark green to gray green, 1 inch or more in diameter; areoles small; glochids white; spines 4 to 10, on upper areoles only, straight, spreading, less than 1 inch long, white with darker tips, not pungent, sometimes flattened.

O. Bruchii Speg., 1925, Argentina. Has been described.

O. securigera Borg, 1937, Patagonia, Prostrate, spreading, up to 8 inches high; joints oval or conic, 2 to 3 inches long and 1½ to 2 inches broad. somewhat flattened on the upper and inner side; tubercles low, broad and rounded; areoles round, large, whitish; glochids yellowish-brown; radial spines 10 to 15, bristle-like, white, less than ½ inch long; central spines 1 to 3, slender, flexible, white, up to 2 inches long; flower unknown. In the Latin diagnosis accompanying his description Dr. Borg gives 3 to 10 as the number of central spines.

O. neuquensis Borg, 1937, southwestern Argentina. Low, prostrate bush, 4 to 6 inches high; joints pale

green, ovoid-conical, 1 to 1½ inches long, less than ½ inch thick, almost smooth; tubercles very low; areoles small, white; glochids few, short, pale yellow; radial spines 2 or 3, bristle-like, white, short; central spine usually 1, rarely 2 or 3, white, flattened, flexible, about 1 inch long; flowers unknown.

O. hypogaea Werd., 1931, northern Argentina. A low, bushy plant; rootstocks woody; joints small, oval, wrinkled, tuberculate, about 1 inch long and half as thick; areoles chiefly on upper part of stem, small, yellowish; glochids numerous; spines 1 to 5, 1 to 1½ inches long, flat reflexed, stiff, white or grayish with darker tips; flowers unknown.

Sub-genus III. *Platyopuntia*

The third sub-genus, *Platyopuntia*, comprises 28 series of plants whose joints are more or less flattened, some of them being pad-like. These flattened joints or stems are frequently erroneously referred to as leaves. About 231 species are included.

RECENT NEW SPECIES SINCE BR. & R.

Series 1. *Pumilae*

Opuntia Hoffmannii Bravo, 1931, Mexico. Prostrate and much branched; joints nearly cylindrical, 6 to 10 cm. long, 2 cm. in diameter, dull green; tubercles prominent; areoles few; glochids yellow; spines 3 to 5, yellow, acicular, 3 cm. long; flowers yellow to reddish; fruit red, spiny.

O. subsphaerocarpa Speg., 1925. Arborescent, densely branched; joints large, oval, glossy green; spines mostly wanting but when present 1 or 2, white, ½ to 1 inch long; flowers yellow.

Series 4. *Tunae*

Opuntia Ekmanii Werd., 1931, Haiti, has been described.

Series 5. *Basilares*

Opuntia basilaris Engel. & Big.



FIG. 11. *Opuntia curassavica*, (Linn.) Miller, x 0.25. Series 2. CURASSAVICAE in the Sub-genus *Platyopuntia*. Photo taken in Curaçao by F. M. Arnoldo.

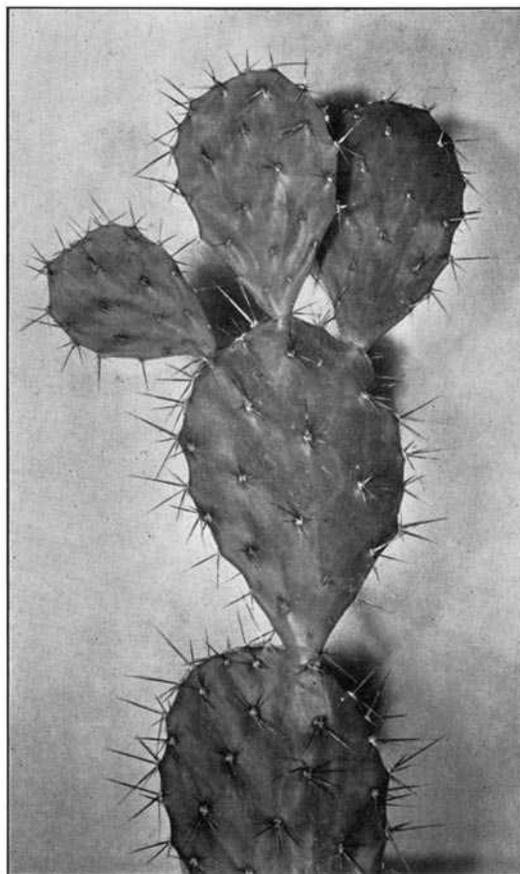


FIG. 12. *Opuntia elatior* (Mill.) Br. & R. x 0.3 Series 12. ELATIORES in the Sub-genus *Platyopuntia*. Native name, "Frikampeuw" Photo by F. M. Arnoldo, Curaçao.

Var. *aurea* Baxter, 1933. Prostrate, forming chains; joints oval to obovate, light green, not glaucous; flowers yellow to pink.

Var. *brachyclada*, Griffiths, 1914. Low, joints erect, cylindrical to slightly flattened; flowers purple.

Var. *humistriata* Griffiths, 1916 joints larger and flatter than the foregoing.

Var. *ramosa* Parrish, 1898, Similar to the species but the joints forming prostrate chains from which other joints stand erect.

Var. *Whitneyana* Baxter, 1935. Joints smaller than the species, reddish color; flower red.

Var. *albiflora* Baxter, 1935 (*O. Whitneyana* var. *albiflora* Baxter). As above but bearing large, white flowers.

O. Herrfeldii Kupper, 1930, Queretaro, Mexico. Plant bushy, erect up to 3 feet; joints round or oval, gray green; areoles closely set, large; glochids reddish-brown; spines wanting; flower sulphur yellow, about 2 inches broad. This species somewhat resembles *O. rufida* but the areoles are more distant.

O. longiareolata Clover & Jotter, 1941, Grand Canyon, Arizona. Seems to be a mere variety of *O. basilaris* with spatulate, yellowish joints, the new growth blue-green.

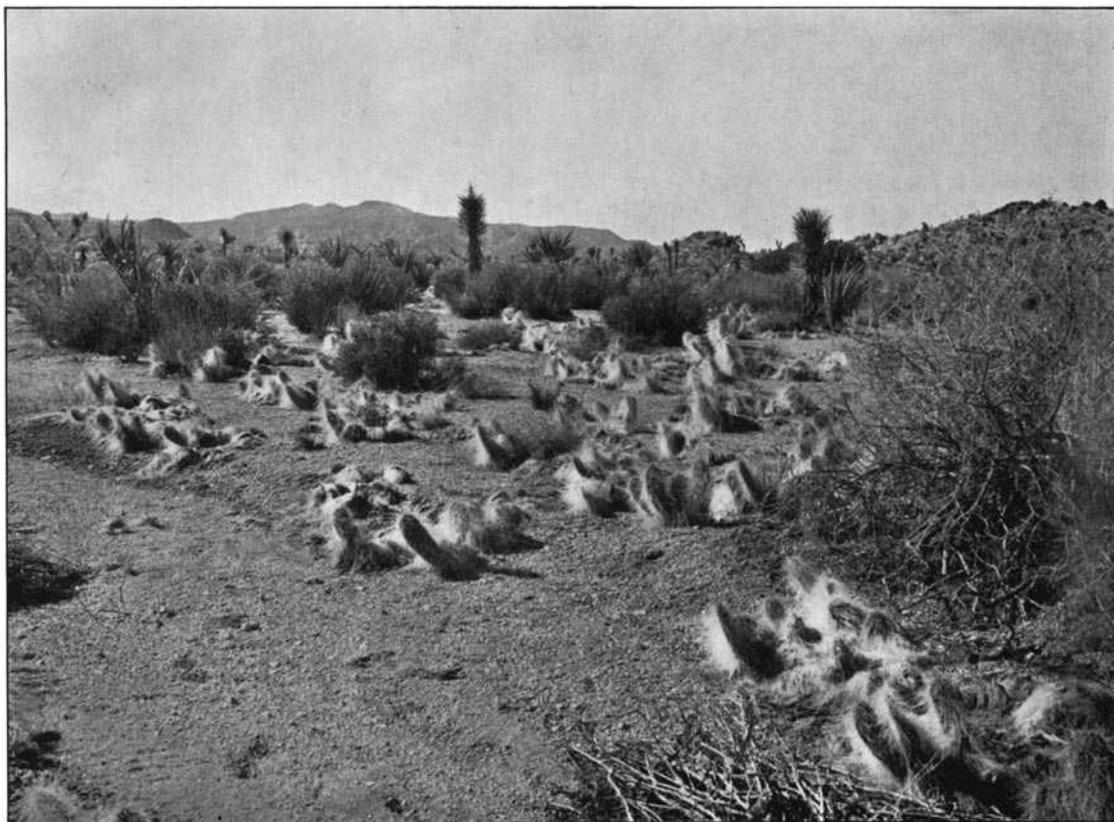


FIG. 13. *Opuntia erinacea* Engelm. Series 23. POLYACANTHAE in the Sub-genus *Platyopuntia*. Habitat photo taken by Ervin Strong in Sunshine Valley, near Ord Mountain, California.

Series 7. **Tortispinae**

Opuntia Loomisii Peebles, 1938, Arizona and New Mexico. Plant small, prostrate or ascending; roots tuberous; joints obovate with constricted base, glaucous; areoles oblong, small, somewhat remote; glochids light brown; spines 1 to 4, at first brownish becoming grayish, 1 to 1½ inches long, from areoles on upper ⅓ of joints only; flowers yellow fading to salmon pink, 2 inches in diameter, fruit greenish-yellow or red tinged.

O. atropicensis Small, 1933, West Virginia, Maryland, and Pennsylvania,

O. calcicola Wherry, 1926, West Virginia, Maryland, and Pennsylvania,

O. cumulicola Small, 1933, Florida.

Series 8. **Sulphureae**

Opuntia boliviensis Bckbg., 1935, Bolivia, near to *O. microdisca* and possibly synonymous with it.

O. Cedergreniana Bckbg., 1935, Argentina.

Series 11. **Phaeacanthae**

Opuntia prasina Speg., 1935, Argentina. Arborescent, many branched, up to 4½ feet high; joints oval, to 10 inches, gray-green or coppery-green; spines wanting or few; flower orange yellow, about 2 inches broad.

O. Howeyi Purpus, 1925, Jamaica. Semi-prostrate bush with many branches; joints rounded, about 4 inches in diameter, very spiny; areoles round; glochids brown; spines ash-colored with dark tips, stiff, about 1 inch long; flowers pale yellow.

O. Bravoana Baxter, 1933, Lower California. Erect, arborescent, 3 to 6 feet high; joints oblong to obovate 15x7 inches, light green with purple spot below each areole; glochids yellow; spines none to 5, flattened, somewhat twisted, to 2 inches long; flowers fading to orange.

Series 15. **Dillenianae**

Opuntia flavescens Peebles, 1937, Arizona. Bushy plant to 3 feet high; joints orbiculate-obovate with a constricted base, glaucous, 10x7 inches; areoles oblong, small, remote; spines 1 to 4 with 1 to 2 accessory spines, from upper marginal areoles; fruit purplish-red.

O. magnifica Small, 1933, Florida.

Series 17. **Tomentosae**

Opuntia Ritteri Berg., 1929, Zacatecas, Mexico. Arborescent; joints round to oval, pale green, tomentose; areoles closely set, round; spines yellow, ascending, about ½ inch long; flowers large, pale red.

O. Spranguei Ortega, 1929, Sinaloa, Mexico. Erect to 6 or 9 feet tall, with a definite trunk. Areoles bear 2 or 3 white spines up to 2 inches long; branches

7 inches long and 4 inches wide, dark green, pubescent; areoles small, bearing white felt and yellow glochids but no spines; flowers clear yellow with a red center.

0. Riley Ortega, 1929, Sinaloa, Mexico. Erect to 9 feet tall with a definite trunk which bears numerous white or gray spines; branches more or less obovate 4 inches by 6 inches or larger, pubescent; spines usually 1, white; flowers about 3 inches in diameter, yellow; fruit not known.

Series 19. *Orbiculatae*

Opuntia pailana Weing., 1928, Sierra de la Paila, Mexico. Up to 3 feet high; joints round or oval, gray green or blue green, 3 to 6 inches long, 2 to 3 inches in diameter; areoles yellowish-brown; glochids yellowish and subtended by brush-like tufts of long, white hairs; spines 3 to 6 or more, about 1 inch long, at first white, later brownish with a darker tip; flowers not reported.

Genus 8. *Consolea* (Lemaire) Britton, in "Cact. & Succ Journ. of Amer.," Vol. 1, 1930.

A group of West Indian plants formerly placed by Britton and Rose in Series 26, *Spinosisimae*, in the genus *Opuntia* but with the notation that five of the species were referred to the sub-genus *Consolea* by Lemaire in 1862. Because these plants are quite distinct from *Opuntias*, Dr. N. L. Britton returned *O. Nashii*, *O. macracantha*, *O. spinosissima*, *O. Millspaughii*, *O. moniliformis*, and *O. rubescens* which constitute the 7 species from Series 26 of Britton and Rose, to *Consolea* and we add 5 new species named since the publication of "The Cactaceae" in 1919.

Consoleas are tree-like, with definite trunks and much-branched tops, the branches flattened; the rather small flowers are colorful and abundant; the fruit is very large as compared with the flower and is flattened like the branches (Pl. 3: Fig. 7).

Habitat: Coastal and interior valleys in the West Indies and the Florida Keys, usually in thorn bush which is over-topped by the *Consoleas*.

Culture: As all of the 11 species are tropical, they require heat and can stand no temperature below freezing and should not be subjected to less than 32 degrees, light but rich soil of large leafmold content is best. In greenhouse

cultivation they will take considerable water if the plants are kept warm.

Uses: Valuable as ornamental plants in the tropics or under glass in cooler regions. The fruits are said to be edible and are used in the manufacture of jelly, cooling drinks, and in candy.

Desirable species: The dark, bronze coloration of *Consolea rubescens* (Salm-Dyck) Lem., makes it especially desirable. *C. moniliformis* (Lem.) Britton, and *C. spinosissima* (Miller) Lem. are also obtainable.

RECENT NEW SPECIES SINCE BR. & R.

Consolea falcata Knuth, (*Opuntia* Ekm. & Werd.), 1931, Haiti, is similar to the taller growing form of *C. spinosissima*, but all the branches are sickle-shaped or falcate; the plant has a densely spiny trunk and the first branches are about 6 to 7 feet above the ground.

C. Urbaniana Knuth, (*Opuntia* Werd.), 1931, Santo Domingo. Another large tree-like plant with densely armed trunk and much branched top.

C. corallicola Small, 1930, Florida.

C. guanicana Knuth, (*Opuntia* Schum. & Gke., 1908), Guanica, Puerto Rico. Resembling *C. rubescens* Salm-Dyck, with which Br. & R. united it, differing, however, in the much greener color.

C. acaulis Knuth, (*Opuntia* Ekm. & Werd.), 1931, Haiti Unlike most species of this genus, this plant does not make a distinct trunk as is implied by the name.

Genus 9. *Grusonia* Reichenbach. Pl. 3: Fig. 8.

This genus was separated from *Opuntia* because of the ribbed joints of the type species and the absence of glochids except at the flowering areoles. It is not a very distinctive genus because glochids are sometimes present in all areoles even in the type species (*G. Bradtiana*) and although in *Grusonia*, the ribs are very pronounced and resemble the ribs of a *Cereus*, this ribbing is

noted in several species of *Opuntia* where confluent tubercles present a rib-like appearance.

Some of the species assigned to this genus by recent writers do not have the distinct ribbing which is the sole constant mark of the genus and are better referred to *Opuntia*. This is true of *Grusonia Wrightiana* Baxter, which the author now considers to be an *Opuntia*. Some of the

recent species assigned to *Grusonia* have the necessary ribbing.

RECENT NEW SPECIES SINCE BR. & R.

Grusonia santamaria Baxter, 1934, Magdalena Island, Baja California. Plant low and spreading; joints cylindrical, ribbed; ribs 8 or 9, more or less spiralled, composed of confluent tubercles; areoles about $\frac{1}{2}$ inch apart bearing glochids when young, but these soon drop off; spines, about 20, occasionally sheathed, none definitely central or radical; flowers rose red without, greenish sulphur-yellow within, becoming light rose colored on the second day. The plant may easily be mistaken for *Cochemiea Halei*, with which it is associated, because of the plum color of the spines.

G. Hamiltonii, an unpublished name, is associated with a plant of this genus from Lower California which shows the ribbing of the plant clearly because of the few spines. It is illustrated in Fig. 14.



FIG. 14. *Grusonia* sp. found near Hamilton's Ranch in Baja California. The description will soon be published by H.E. Gates. Photo by Scott Haselton in R. W. Kelly's garden.

Tribe III. CEREEAE

Sub-tribe 1. Cereanae

Genus 1. *Cereus* Miller, 1768. Pl. 4: Fig. 1.

At various periods, over nine hundred plants have been published in the genus *Cereus*, most of which are now referred to other genera. The 26 species included in the genus may be upright and tall, but sometimes low and spreading, generally much branched, the branches ribbed or angled (Pl. 1: Fig. 9); areoles or spine-cushions producing spines and usually short wool, but never silky hairs, nor glochids.

The flowers bloom at night and are funnel-shaped. After blooming, the upper part of the flower, except the style, falls off leaving the ovary to become the fruit with the style dried but still attached (Pl. 5: Fig. 1). The flowers are white tinged with red or pink and the ovary and tube bear very few, if any, small, leaf-like scales but no spines or wool. The fruit is fleshy, red or yellow, smooth, and splits down one side when mature.

Habitat: From the southern West Indies

through eastern South America to Argentina.

Culture: Many of the species will stand temperatures down to freezing and therefore can be cultivated out of doors in sub-tropical or tropical climates where a fairly heavy soil can be used and plentiful water given in warm seasons. In glasshouse cultivation they require a lighter and richer soil. They propagate easily from cuttings and grow rapidly from seeds.

Desirability: As most of the *Cerei* are large plants, they make splendid backgrounds for outdoor plantings and are desirable even for greenhouse cultivation because of the number and size of the flowers produced. Seedlings make interesting plants, but become too large for a limited space. The varied glaucous colorations rival the overcast bloom as found on some fruits, and this effect on new growth lends color to collections.

Uses: As ornamentals, they have been introduced into most tropical and sub-tropical countries where they soon become large trees. The fruits of many species are edible and are eaten raw or made into jellies and candy. They are most valuable, either in seedling form or as cuttings for grafting stock (Cact. & Succ. Journ. of Am., Vol. 10: pg. 108) for less hardy cacti.

Desirable species: *Cereus peruvianus* (Lin.) Miller, and its innumerable hybrids take first place, but the silvery gray *C. caesioides* Salm-Dyck, and the long-spined *C. validus* Haw., are prime favorites. *C. alacriportanus*, Pfeiff. *C. hildmanianus* Sch., and *C. jamacaru* D.C. are obtainable and attractive. *C. obtusus* Haw., *C. variabilis* Pfeiff. and *C. pernamibucensis*. Lem. are low, sprawling plants that add to the variety of collections.

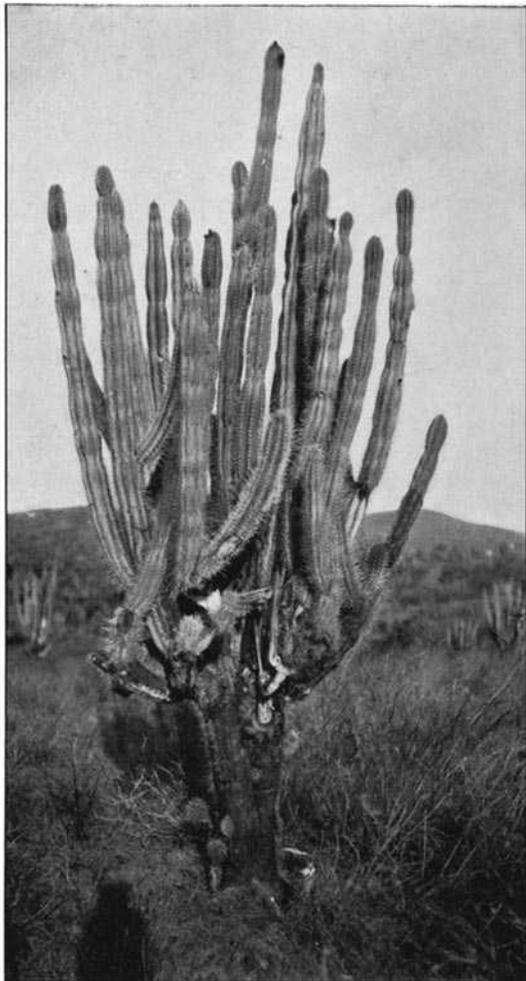


FIG. 15. *Cereus repandus* Miller x 0.02. Photo taken on Curaçao, Dutch West Indies, by F. M. Arnoldo,

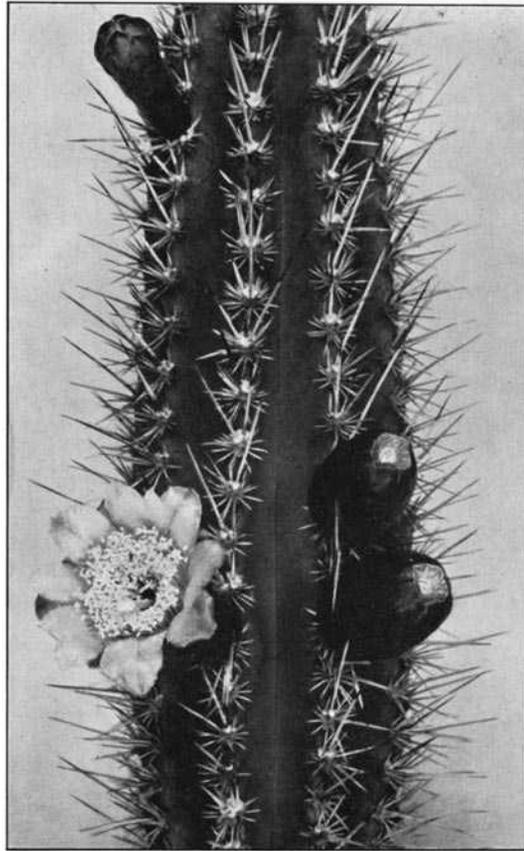


FIG. 16. *Cereus repandus* Miller x 0.33. Details of branch, flower and fruit. Photo by F. M. Arnoldo, Curaçao.

Cereus Huntingtonianus Weing., which greatly resembles *C. validus* and *C. Childsii* Blanc, with which it is considered synonymous, is obtainable and desirable because it is one of the few pink-flowering Cerei. A complete description of this plant can be found in Cact. & Succ. Journ. of Amer., Vol. IV: pg. 374.

C. Mieckleyanus Weing., 1932, is merely a monstrose form of *Lophocereus Schottii* and does not belong here

C. coerulescens Salm-Dyck var. *melanacanthus* Sch. has larger, shining black spines.

C. Hankeanus Weber, 1897, is offered in the trade but we agree with Br. & R., who referred it to *C. validus* as a synonym.

C. horribarbis Otto, was referred to *C. jamacaru* by Br. & R. and most students consider it a monstrose form of that species.

C. rosiflorus Speg., 1925, from Argentina, is a species described as having rose-colored flowers. It is not known to us.

C. repandus Lin., has been assigned to *Harrisia gracilis* by both Backeberg and Borg, but it is actually a good species as claimed by Br. & R. We are indebted to Mr. H. O. Bullard for the excellent habitat photograph of the species taken by Mr. Arnoldo in Curaçao.

Genus 2. *Monvillea* Br. & R., 1920. Pl. 5: Fig. 2.Syn: *Cereus* (Monville, 1840) 1754.

This genus differs from *Cereus* in its thinner, half-erect stems, and smaller but more prolific flowers. The flower is said to be persistent, as its upper part withers slowly and dries attached to the end of the smooth, red, juicy fruit. Flowers arise from near the top on the sides of the stems. The name commemorates M. Monville, a well-known student of cacti, and today there are 10 known species.

Habitat: The Plants of this genus range from Brazil, Peru, and Paraguay to Argentina. One species, *M. insularis* Hemsley, is from an island off the coast of Brazil.

Culture: Loose soil, rich in leafmold produces best results, and if sufficient water is supplied in warm weather a rather considerable growth can be made. The plants will stand but little cold and seem to prefer partial shade. Cuttings will flower sooner than plants grown from seed, and are quite plentiful.

Desirability: Because of the number and beauty of flowers, this genus has met with great favor. The half-erect habit of the moderately tall plants makes them desirable for middle foreground position in landscaping, while the comparatively small room needed for potted plants makes it an acceptable group for greenhouse culture.

Desirable species: *Monvillea Cavendishii* Monv., is one of the most prolific bloomers of all cacti, flowering from April to September. The flowers open in the early evening. *M. marmorata* Zeiss and *M. Spegazzinii* Weber, are attractive because of their mottled or marbled stems and the beauty of their flowers. *M. diffusa* Br. & R., is a larger and more erect plant than other species of this genus and is obtainable.

RECENT NEW SPECIES SINCE BR. & R.

Monvillea Smithiana (Rose) Werd. (*Pilocereus* Rose and *Cephalocereus* Br. & R.) is from Venezuela. This plant was listed as *Cephalocereus* No. 14 in "The Cactaceae," Vol. 11: pg. 37, with the notation that the flower "is not quite typical of the genus" (*Cephalocereus*). Actually, it is a typical *Monvillea* flower though rather shorter than the other species, and the fruit bears the perianth remains. We concur in the opinion of Dr. Werdermann in placing this species in the genus *Monvillea*.

M. phaeacantha (Gürke) Werd., (*Cereus* Gürke

and *Cephalocereus* Br. & R.), has a shorter flower tube than the typical *Monvillea* and has more pronounced scales, but we agree with Dr. Werdermann in placing it here rather than in *Cephalocereus*, to which Br. & R. assigned it with this notation, "We have placed this species near the end of the genus for it is very unlike the other species and may not be cogenetic with them."

M. marmorata (Zeiss) Fric, (*Monvillea Anisitzii*



FIG. 17. *Monvillea Spegazzinii* (Weber) Br. & R. x 1.
Photo from "The Cactaceae" by Britton and Rose.

Berg.), is probably only a variety of *Monvillea Spegazzinii* (Weber) Br. & R. The stems are more often 5-angled and more rounded, and the flowers are this somewhat larger.

M. Cavendishii (Monv.) Br. & R. has four varieties:

Var. *saxicola* Morong. (*M. saxicola* Berg.) has 6 to 9 ribs with 7 radial spines and 1 central.

Var. *rhodoleucantha* Schum. (*M. rhodoleucantha* Berg.) has 9 ribs with 6 to 7 radial spines and 1 to 3 centrals; stems taller.

Var. *Paxtoniana* Monv. (*M. Paxtoniana* Borg) has 9 ribs, 7 to 9 radial spines and 1 to 4 centrals; stems thicker.

Var. *Lauterbachii* Schum. (*M. Lauterbachii* Borg), has 7 to 9 ribs with 9 radial spines and 3 to 5 centrals; stems mostly prostrate.

M. Brittoniana Werd., is a synonym of *Monvillea*
maritima Br. & R.

M. Lindenzweigiana (Gürke) Bckbg., 1906, is a
name only



FIG. 18. *Cephalocereus fluminensis* (Miquel.) Br. & R., on a rocky hillside near Rio de Janeiro. Photo by Curt Backeberg.

Genus 3. *Cephalocereus* Pfeiffer, 1838. Pl. 5: Fig. 3.

Syn: *Cereus* Miller, 1754.

Syn: *Cephalophorus* Lem., 1838.

Syn: *Pilocereus* Lem., 1839.

Cephalocereus, as re-established by Br. & R., contained species of divergent habits, many of which were too little known at the time for sure determination as was stated in a number of instances. As here presented, the genus is limited to plants of similar characteristics which come within the limits of the following amended description:

Elongated cacti mostly columnar and erect, sometimes much branched, but in one species with spreading and procumbent branches; the rather small, bell-shaped flowers arise from a terminal or lateral cephalium furnished with bristles, this cephalium is sometimes sunken in a groove but may arise from normal ribs; the top-shaped fruits are naked and remain bidden in the cephalium until ripe when they are thrust out.

From this genus we exclude *Cereus leucostele* Gürke which we refer to the genus *Stephano-*

cereus and *Cephalocereus Smithianus* Br. & R., which, with *Cereus phaeacanthus* Gürke, we refer to the genus *Monvillea*. A large number of Britton and Rose's species we refer to the genus *Pilocereus*.

We retain in *Cephalocereus* the following species which were included by Br. & R. and meet the generic requirements noted above: *Cephalocereus senilis* (Haw.) Pfeif., *C. hoppenstedtii* (Weber) Schum., *C. purpureus* Gürke., *C. fluminensis* (Miquel) Br. & R., and *C. Dybowskii* (Gosselin) Br. & R. In addition to these, we include the species listed under the heading of new species in this section.

Habitat: Mexico, Bolivia, and Brazil.

Culture: Plants of this genus seek shade at least in the seedling stage and all species favor soil rich in natural leafmold. This indicates that the soil preparation should be rich but loose and with free drainage, and some shade should be

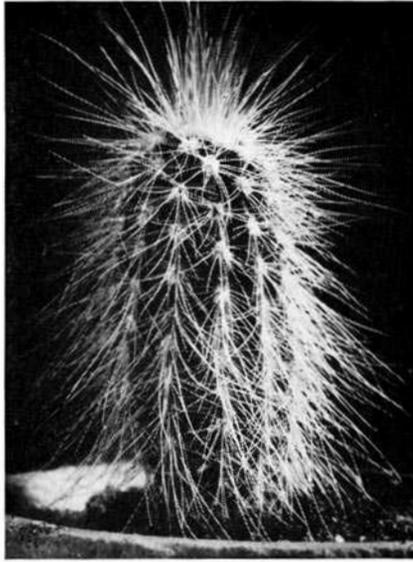


FIG. 19. Seedling of *Cephalocereus Hoppenstedtii* Schum. x 1.

supplied to young plants. Water can be freely supplied in warm weather after plants are well established.

Desirability: Cephalocerei are among the most showy of cactaceous plants and have been prime favorites for generations. No collection can be complete without a few species of this genus.

Desirable Species: Among the most popular ornamentals are *Cephalocereus senilis* (Haw.)

Pfeif., "The Old Man of the Desert," which is the first cactus desired by most collectors, but *C. Hoppenstedtii* (Weber) Schum., *C. Dybowskii* (Gosselin) Br. & R., and *C. fluminensis* (Miquel) Br. & R., are obtainable and they all add interest and color to any collection.

RECENT NEW SPECIES SINCE BR. & R.

Cephalocereus Guntheri Kupper, 1931. Andes Mountains. Stem glaucous green; ribs 12 to 16 furnished with small, approximate areoles which bear 10 to 15 golden yellow spines which increase from 25 to 27 in the cephalium. All spines are bristly, but those in the cephalium more pronouncedly so. This cephalium is on one side of the stem only and in mature plants extends from the crown down for about 20 inches, the flowers are bell-shaped, yellowish-white, and about 3 inches long.

C. polyanthus Werd., 1933, Bahia, Brazil. Branching from base and becoming about 4 feet tall. The branches are up to 2 inches in diameter with 15 to 20 ribs; radial spines 20 to 30, needle-like, white to yellow, short; central spines 3 to 7, golden, about one inch long; flowers produced from a pseudocephalium, are rosy-red, small; the rosy-red fruit is very small.

C. Lehmannianus Werd., 1933, Bahia, Brazil. Grows to 7 feet tall, branching at the base or above; stems bluish in color, 2 to 3 inches thick and densely woolly and spiny at the tips; ribs about 20, bearing closely set, woolly areoles each of which has about 40 needle-like, whitish to yellowish spines up to nearly an inch long; the cephalium on the side of the stem near the top bears long, grayish or rusty wool from which arise the very small flowers which are dark pink outside and white inside; fruit purplish, pear-shaped, about one inch long.

Genus 4. *Pilocereus* Lemaire 1839, amended Berger 1905.

Many of the species produce flowers from a lateral pseudocephalium of long hairs. A few species also have bristles in the pseudocephalium, while still other species produce no pseudocephalium. In fact, in some species no hairs are produced from the areoles.

The perianths of the fairly short, tubular flowers spread widely and the few scales on the tube are naked in their axils. The fruits are usually flattened and are visible while ripening.

Convenience is best served by considering this group as one genus rather than erecting several genera. A contemporary writer refers to his genus *Subpilocereus* the Venezuelan and Colombian species with elongated fruits; to his genus *Micranthocereus*, he refers species with many small flowers from a pseudocephalium and hav-

ing capped fruit; in *Austrocephalocereus*, he places the Brazilian species with pseudocephalium and naked flowers; and to *Coleocephalocereus*, the Brazilian species of *Cephalocereus* with channelled pseudocephaliums.

There is a deplorable tendency to split the accepted genera for minor differences which, if carried to its natural conclusion, will create a confusion so great as to necessitate a return to the few, large genera of Schumann as more convenient than innumerable small, poorly differentiated genera.

Pilocereus, as here considered, shows a wide geographical range indicating great antiquity for the genus. Representatives may be found from Mexico and Florida through the West Indies to Venezuela, Colombia, Brazil, Peru and Bolivia.

The following species are transferred to *Pilocereus* from the genus *Cephalocereus* of Br. & R.:

P. arrabidae Lemaire, 1862, of which *P. exerens* Schumann is a synonym, Brazil.

P. albispinus (Salm-Dyck) Rümpler, 1822, Curaçao.

P. alensis Weber, 1905, Jalisco, Mexico.

P. bahamensis (Britton) Knuth, 1909, Bahamas.

P. barbadosis (Br. & R.) Berger, Barbados.

P. brooksianus (Vaupel) Knuth, 1912, Cuba.

P. catiingicola (Gürke) Werdermann, 1908, Brazil.

P. chrysacanthus Weber, 1897, Mexico.

P. colombianus (Rose) Backeberg, 1909, Colombia.

P. Collinsii (Br. & R.) Knuth, 1923, Oaxaca, Mexico.

P. cometes (Scheidweiler) Knuth, 1840, Mexico,

P. Deeringii (Small) Knuth, 1917, Florida.

P. euphorbioides (Haworth) Rümpler, 1819, Mexico.

P. Gaumeri (Br. & R.) Knuth, 1920, Yucatan.

P. glaucescens Labouret, 1853, Brazil.

P. Gounellei Weber, 1897, Brazil.

P. Gounellei Weber var. *Zehntneri* Br. & R., 1920, Brazil.

P. Hermentianus (Monville) Lemaire, 1859, Haiti.

P. keyensis (Br. & R.) Knuth, 1909, Florida.

P. lanuginosus (Linnaeus) Rümpler, Curaçao.

P. leucocephalus Poselger, 1853, Sonora and Chihuahua, Mexico.

P. macrocephalus Weber, 1898, Mexico.

P. monoclonos (De Candolle) Knuth, 1828, Caribbean Islands.

P. Moritzianus (Otto) Lemaire, 1837, Venezuela.

P. Millspaughii (Britton) Knuth, 1909, Bahamas.

P. Maxonii (Rose) Knuth, Guatemala.

P. nobilis (Haworth) Schumann, 1812, West Indies.

P. Palmeri (Rose) Knuth, 1909, Mexico. A possible variation of *P. cometes*.

P. pentaedrophorus (Labouret) Lemaire, 1853, Brazil.

P. piahyensis (Gürke) Werdermann, 1908, Brazil,

P. polylophus (De Candolle) Salm-Dyck, 1828, Mexico.

P. polygonus (Lamarck) Schumann, 1783, Santo Domingo.

P. Purpusii (Br. & R.) Knuth, Mazatlan, Mexico.

P. Robinii Lemaire, 1864, Cuba.

P. Royenii (Linnaeus) Rümpler.

P. Russelianus (Otto) Rümpler, 1850, Venezuela.

P. Sartorianus (Rose) Berger, 1909, Mexico. Possibly a variation of *P. cometes*.

P. sublanatus (Salm-Dyck) Foerster. (*Cephalocereus brasiliensis* Br. & R.).

P. Swartzii (Grisebach) Knuth, Jamaica.

P. tetetzo Weber, 1897, State of Puebla, Mexico.

P. Tweedyanus (Br. & R.) Backeberg, 1920, Ecuador.

P. Ulei Schumann, 1903, (*Cephalocereus robustus* Br. & R.), Brazil.

P. Urbanianus Schumann, 1909, Guadeloupe Island, West Indies.

Explorations in recent years, principally by Dr. E. von Werdermann and Curt Backeberg, have resulted in the discovery of many new species referable here which are described under the heading of new species.

Culture: In spite of the very wide range of distribution of species in this genus they all respond to a rich but loose soil and will take a fair amount of water in warm weather. Soil should contain equal parts of sharp sand, good top soil, and leafmould. These species adapt themselves to hot-house culture and do not seem to need as much root room as others of the Cerei. When potted, a treatment of liquid fertilizer in the spring is beneficial.



FIG. 20. *Pilocereus leucocephalus* Poselger x 0.3. Photo by Graham Heid of an inntorted plant in Knickerbocker Nursery in San Diego, California.

Desirability: A group of *Pilocereus* should be part of every collection because of the great variability of form, each with a peculiar charm of its own. But few of the species are suited to outdoor, all-year culture, but they can be potted for the colder months and the pots set out in rockeries for the warmer months, with good results.

Uses: Throughout their range, species of *Pilocereus* are used for hedges. A few have edible fruits but their greatest value is as ornamentals.

Desirable species: *Pilocereus leucocephalus* Fig. 20, is especially desirable, with its woolly pseudocephalium which looks as though an Angora goat had rubbed past, leaving part of its coat on a few ribs of the plant. In a lesser degree, *P. cometes* and its associated species, and the golden-spined *P. chrysacanthus* are well liked. Any of the species are valuable additions to a collection.

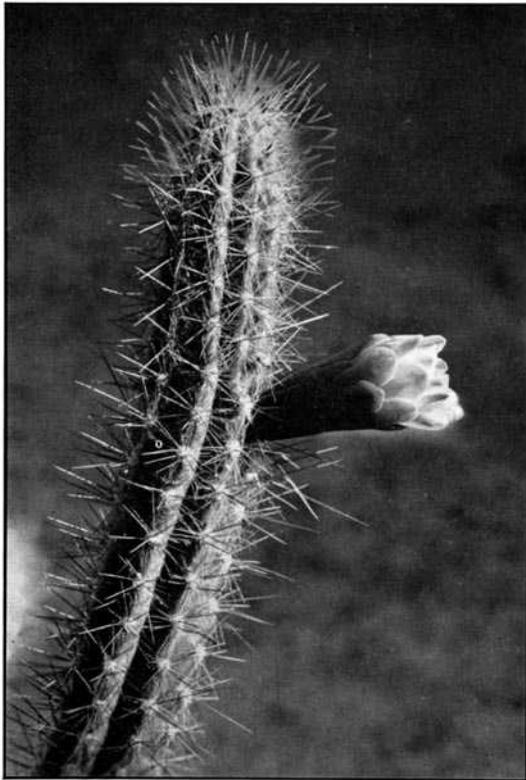


FIG. 21 The rare *Pilocereus nobilis* (Haw.) Schum. x 0.5, flowering in the F. L. Kennedy gardens in Long Beach, California. Photo by Scott Haselton.

RECENT NEW SPECIES SINCE BR. & R.

Pilocereus arenicola Werd., 1933, Bahia, Brazil. 12 to 15 feet tall, branched, gray-green; ribs 6 or 7; areoles with thick grey wool and with thick white hairs, especially in the flowering region; radial spines 8 to 9 appressed, heavy acicular, yellow; central spines 5 to 6, yellowish or brownish to ½ inch long; flowers unknown; fruit flattened.

P. atroviridis Bckbg., 1930, Colombia. Grows to 38 feet high with a trunk 10 inches thick; ribs 8; radial spines about 8, short; central spines 3, to almost an inch long; flowers unknown; fruit reddish-green.

P. aurisetus Werd., 1933, Brazil. Short, 3 feet high,

branched at base; bluish-green; ribs 15; areoles close set with grayish wool and short white hairs and many needle-like yellowish-gray spines about 1 inch long; pseudocephalium extends half way down stem and is composed of golden bristles up to 2 inches long; flowers about 2 inches long, white with pointed petals.

P. Backebergii (Weing.) Bckbg., 1930, Puerto Cabello, Venezuela. Few but stout branches to about 16 feet tall, 4 inches or more thick, bluish-green; ribs 9 to 15; areoles with short brown felt and curly, silken hairs which are more pronounced on flowering areoles; radial spines 10 to 12 about ½ inch long; central spine 1 about 1 to 2 inches long, all spines horn-colored; flowers yellowish-green; fruit flat, violet with waxy coating, pulp red.

P. Bradei (Bckbg.), Voll, 1935, Brazil. About 6 feet high, branched, powdered to a sky-blue; ribs about 10; areoles about 1 inch apart, bear gray wool; about 6 radial spines and 1 or 2 central spines, all spines chocolate brown; flowering branches are frequently without spines; flowers over 2 inches long, greenish-white.

P. Catalani Riccob., 1921. About two feet tall with 6 thick ribs which have areoles ⅓ to ⅔ inches apart; 6 to 8 radial spines, these very short and widely spreading; 1 or 2 longer and stouter central spines; flowers 4 inches long, opening 2 inches wide.

P. chrysostele (Vaupel) Werd., 1923, Brazil. Grows to 16 feet high, branched, deep coppery-green; ribs 12 to 18; areoles small, close set and furnished with yellow wool and silky, whitish hairs which are more numerous at the crown; 12 to 20 bristle-like, yellow (or red) spines; 1 to 4 shining central spines, yellow at base and tip with red between; flower 2 inches long, olive-green; fruit flat.

P. claroviridis Bckbg., 1931, Venezuela. Branches 2 to 3 inches thick with about 7 ribs; areoles woolly; radial spines 10 to 12, brown; central spines 1 to 3; flowers and fruit unknown.

P. cuyabensis Bckbg., 1935, Brazil. Simple or branched, branches slightly over 2 inches thick, gray-green and slightly powdered; areoles closely set bearing hairs and about 15 needle-like, dark yellow spines, one of which is longer than the others but only about ½ inch long; flowers from the very woolly crown of the stem, cream-white.

P. Fricii Bckbg., 1930, Venezuela. Tree-like; ribs 4 to 5; areoles with wool and about 7 radial spines and 1 to 3 central spines; all spines horn-colored with brownish tips, flower greenish; fruit flattened, violet.

P. glaucochorus Werd., 1933, Brazil. Stems slender, 1 to 1¼ inches thick, powdered, bluish-green, with 5 to 8 ribs; occasionally 9; areoles with yellow wool and silken hairs up to an inch long and 9 to 12 acicular yellow radial spines and 1 to 4 stronger, yellow central spines up to 2 inches long; flowers from 1 or 2 ribs on the west side of the plant from densely woolly areoles are about 2 inches long, rose colored to white; fruit flattened, green to reddish.

P. hapalacanthus Werd., 1933, Brazil. To 16 feet tall with numerous branches from near the ground, bright-green to gray-green; ribs about 12; areoles with gray wool and white hairs; spines 15 to 20 fine needle-

shaped, flexible, bunched, about $\frac{1}{2}$ inch long or one somewhat longer, yellow to brown when young, later darker; flowers near the top from very woolly areoles are over 2 inches long, cream-colored; fruit spherical, dark green.

P. horrispinus Bckbg., 1930, Colombia. Columnar branches 4 to 5 ribbed, new growth blue-green later olive green; areoles heavily felted, distant; radials 6 or 7, to 1 inch long, whitish-gray later horn-gray; central spine 1, up to 4 inches long, porrect; flowers from hairy areoles, lilac-rose; fruit ovate, rose with a blue tinge; seed black, dull.

P. Luetzelburgii (Vaupel) Werd., 1923, Brazil. Unbranched to 3 feet high; when young ball-shaped, then elongated egg-shaped, mature plants bottle-shaped and leaning toward the west; dark green, woolly at apex; ribs 13 to 16; areoles closely set with white wool and 15 to 18 yellowish to gray radial spines, interwoven and bent, needle-shaped; central spines 4 or more, not easily distinguished from the radials, but stronger and one of them over an inch long, transparent horn-gray later gray; flowers from areoles near the apex which bear long hairs, 2 inch long, whitish; fruit flattened.

P. mezcalaensis (Bravo, 1932) comb. nov., Rio Mezcala, Mexico. Not branched, columnar to 20 feet tall and 10 or more inches in diameter, yellowish-green; ribs 15 or more, prominent; areoles nearly an inch apart, with yellow felt and 6 or 7 short straight, white or yellow radial spines with brown tips, later gray; central spine 1, longer than the radials; flowers nocturnal, perfumed slightly; funnel-shaped, about 2 inches long; the tube bears scales which are naked in their axils; outer perianth segments white or greenish-white; filaments and style white; anthers yellow stigma lobes greenish-yellow; fruit globose, 2 inches in diameter, naked, carmine; seed black.

P. minensis Bckbg., 1933, Brazil. Up to 6 feet high, branches about 2 inches in diameter; ribs 13; areoles closely set bearing felt and about 20 spines which are acicular, dark brown and up to nearly an inch long; flowers 2 inches long and slightly over an inch broad.

P. oligolepis (Vaupel) Werd., 1913, Brazil. Slightly branched to 3 feet high with 5 sharp ribs; areoles approximate or nearly so bearing short wool and hairs which at the apex conceal the ribs; radial spines 8 to 10 very short, needle-like and spreading; central spines standing out perpendicularly somewhat longer and stouter than the radials; flowers near the top of the plant pointing upwards, over 2 inches long, whitish; fruit compressed, over an inch in diameter; seeds dark and pitted.

P. perlucens (Schum.) Werd., 1900, Brazil. This species was described from specimens sent from Manaus, Brazil, and has not since been collected. The type was a sterile plant so it is referred here by Dr. Werdermann doubtfully. It is described as having an upright trunk, branched; ribs 5 to 6; color oil-green with spots and in young shoots with a violet tint; radials 8 to 10, short, chestnut-brown, needle-shaped; central spines separate or in pairs, not always larger, black in age; flowers and fruit unknown.

P. remolinensis Bckbg., 1930, Colombia. To 38 feet tall, strongly branched; new growth bright green, later dark green or gray; ribs 6 to 7; areoles nearly an inch apart with a little felt and 7 to 13 radial spines which are very short, and a very little hair on the youngest areoles; a V-shaped groove runs down the sides of the ribs from each areole; flowers about $2\frac{1}{2}$ inches long, cream inside with lilac-pink tips; fruit oval, yellowish-green; seeds fairly large, smooth.

P. rupicola Werd., 1933, Brazil. To 20 feet high, somewhat branched at the base; ribs 9; areoles about $\frac{1}{2}$ of an inch apart, at first with gray wool, later bare, and with short hairs of a whitish-gray in the areoles near the apex, sparse in non-flowering areoles but dense in flowering ones; spines all alike, about 18 to 21 to an areole, at first yellow, later brown to dark gray, needle-shaped with thickened base; flowers and fruit not known.

P. salvadorensis Werd., 1933, Brazil. Tree-like to 12 feet tall and much branched, greenish or gray, very soft fleshed; branches to 4 inches thick; ribs 7 to 9; areoles about $\frac{1}{2}$ inch apart, bear whitish wool and near apex there are drooping hairs; radial spines 10 to 11, appressed, short, acicular or the lower ones bristle-like, at first yellow, later brown with darker tips; central spines 4 in the form of a cross, the largest 1 inch long, heavy acicular, pungent, thickened at base, yellow at first, later darker; flowers unknown; fruit flattened to 2 inches in diameter.

P. sergipensis Werd., 1933, Brazil. To 10 feet high, slightly branched, glaucous blue; ribs 6; areoles $\frac{1}{2}$ inch apart bearing white to gray-brown wool and at the apex there is an abundance of white hairs; radial spines 8 to 11, acicular, short, at first horn-colored later brown-yellow to almost black; central spines 2 to 4, somewhat stronger than, but hard to distinguish from the radials; flowers unknown; fruit somewhat flattened, reddish-green.

P. tehuacanensis Weingart, 1927, Mexico. Ribs about 15; areoles 1 cm. apart containing felt and hairs, about 25 acicular radial spines 1 to 2 cm. long, which later become gray; flowers and fruit unknown.

P. tuberculatus Werd., 1933, Brazil. Candelabrum-shaped to 12 feet tall, branches from the base; joints at first horizontal, then upright, 1 to $1\frac{1}{2}$ inches thick, dark green; ribs 7, very wavy; areoles large with gray to brown wool but no hairs; radial spines 9 to 13 not uniform in length; central spines hard to distinguish from the radials, 4 to 7, stronger than the radials and one or two of them to $1\frac{1}{2}$ inches long; all spines flexible, acicular, horn-colored with darker tips; flowers about 2 inches long or more, white; fruit relatively small, flattened, smooth.

P. Verheinei Rümpler is described in "The Cactaceae," Vol. II: pg. 58, but is unknown to me although included in this genus by Knuth, "Kaktus ABC" pg. 334.

P. Vollii Bckbg., 1935, Brazil. Knuth places this as a natural hybrid between *P. arrabidaei* and *Cephalocereus fluminensis*.

Genus 5. **Stephanocereus** Berger, 1926. Pl. 5: Fig 5.

This genus produces its pale white, funnel-form, diurnal flowers from a terminal cephalium of bristles through which the stem continues to grow, leaving a ring of bristles around the stem and the bluish green fruit is produced from this

ring of bristles. The one species, *Stephanocereus leucostele* (Gürke) Bckbg., was included in *Cephalocereus* by Britton and Rose. Seedlings are available and can be treated as indicated for *Arrojadoa*.

Genus 6. **Browningia** Br. & R., 1920.

The one species, *Browningia candelaris* (Meyan) Br. & R., of this genus is tree-like with most grotesquely bent branches. Seedlings and young branches are very spiny but in age they lose all spines. The funnel-shaped flowers bloom at night and are nearly white and slightly curved; the flower tube (Pl. 5: Fig. 6) as well as

the yellow fruit, is covered with large, thin scales but no spines.

Culture: Seedlings only are available, and these are sensitive to cold and prefer a loose, rich soil.

Desirability: Very interesting in seedling stage becoming outstandingly grotesque in age.

Genus 7. **Stetsonia** Br. & R., 1920.

Another genus with but one known species, *Stetsonia coryne* (Salm-Dyck) Br. & R. It is an immense, tree-like plant, the funnel-shaped flowers are large and arise from the upper part

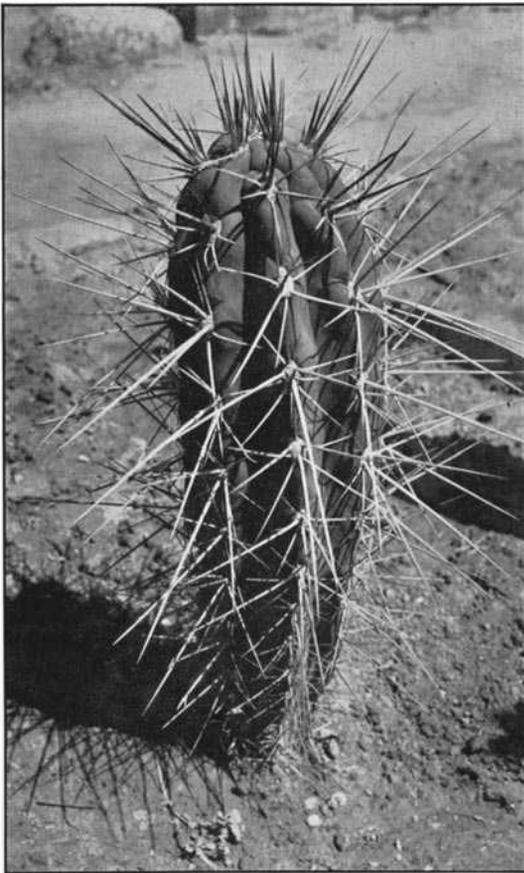


FIG. 22. Seedling of *Stetsonia coryne* (Salm-Dyck) Br. & R. x 0.25. Photo by Scott Haselton in his gardens, Altadena, California.

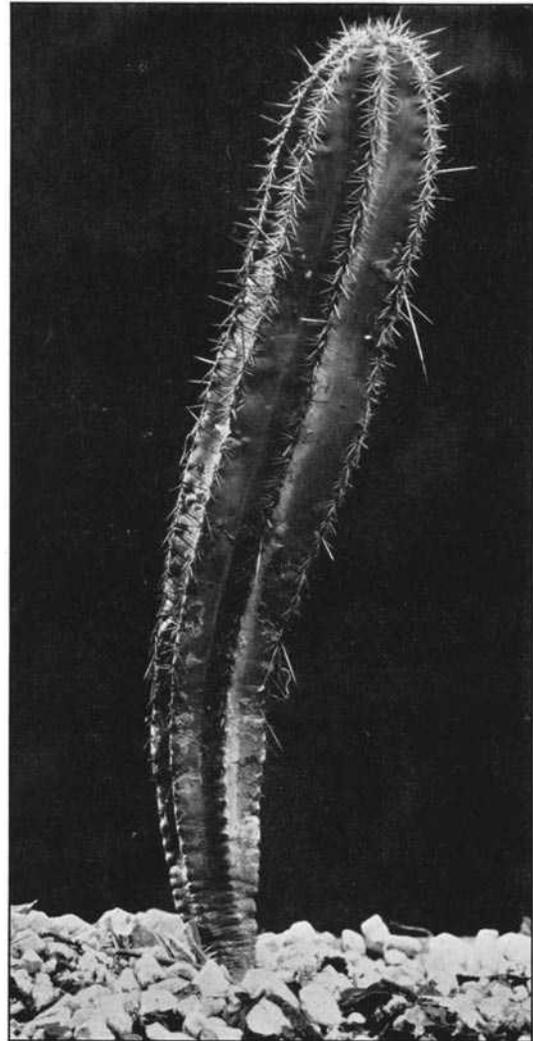


FIG. 23. Seedling of *Escontria chiotilla* (Weber) Rose x 0.3

of the branches. The long globe-shaped ovary and cylinder-shaped flower tube are covered by small, parchment-like scales (Pl. 5: Fig. 7) which set it off from others in this sub-tribe.

Seedlings are available (Fig. 22) and are very desirable for their gray color accented by the heavy, awl-shaped, black spines. The plant is native to north-western Argentina.

Genus 8. *Escontria* Rose, 1906.

A Mexican genus whose one species, *Escontria chiotilla* (Weber) Rose, also forms a tree of immense size. It has a small yellow flower which is rather bell-shaped and blooms by day. The globe-shaped ovary and the flower tube are covered by triangular, papery scales, translucent in coloring.

The globe-shaped, purple, fleshy fruit (Pl. 5: Fig. 8), also has the papery scales but is edible and is sold in the markets under the name of "chiotilla". The dried fruits which taste like gooseberries are also sold in the markets in Mexico. It is a desirable species for collectors, the seedlings being obtainable.

Genus 9. *Corryocactus* Br. & R., 1920.

The three species of this genus form bushy plants of many short, columnar stems branching at the base. They are strongly ribbed and very spiny. The rather large yellow or orange-colored flowers are bell-shaped or funnel-shaped. The ovary and flower tube have many very conspicuous areoles with brown or black wool and very small scales (Pl. 6: Fig. 9). The globe-shaped fruit (Pl. 6: Fig. 9) is very spiny.

Habitat: Peru and Bolivia in mountainous country.

Culture: Ample room is necessary due to the base-branching habit of these plants. They are frost tender. Like most members of this sub-tribe they like loose, quick-draining, but fairly rich soil.

Desirability: One species adds interest to a collection but they are not sufficiently spectacular to justify much room and seldom flower in cultivation.

Desirable species: *Corryocactus melanotrichus* (Schum.) Br. & R. (Fig. 24) and *C. brachypetalus* (Vaupel) Br. & R., are obtainable as seedlings.

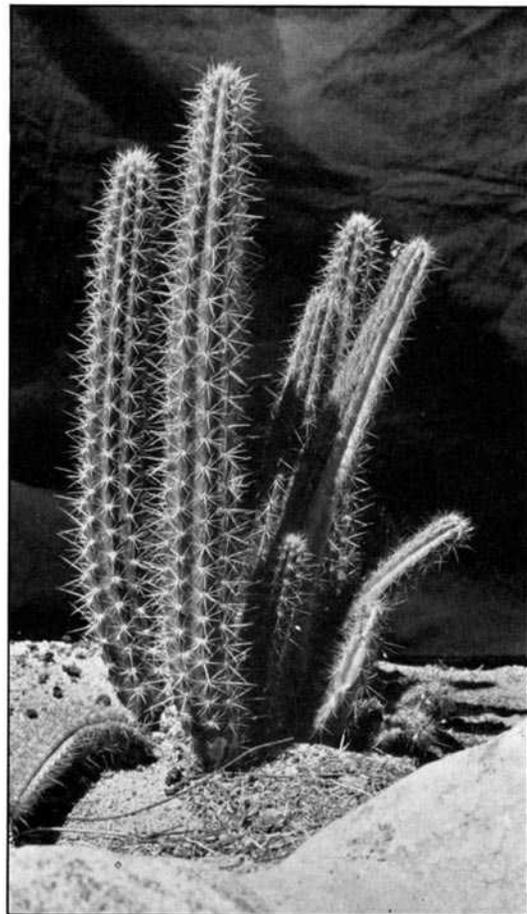


FIG. 24. *Corryocactus melanotrichus* (Schum.) Br. & R., x 025. Photo by Graham Heid.

Genus 10. *Pachycereus* (Berger) Br. & R., 1909.

The genus *Pachycereus*, which means "thick *Cereus*", includes ten or more species, all natives of Mexico. Tree-like plants, branching from the trunk, they attain a height of 40 to 60 feet and dominate the landscape.

The day-blooming flowers are rather small for such large plants, are funnel-shaped and the ovary and tube are covered with small scales with felt and bristles in their axils.



FIG. 25. *Pachycereus Gaumeri* Br. & R., x 0.15 flowering at Knickerbocker Nursery in San Diego, California, Photo by George Lindsay. The relationship of this species is still in doubt as fruit has not been seen.

The dry fruit is globe-shaped and densely covered with spines, resembling a chestnut burr (Pl. 6: Fig. 10). This peculiarity of the fruit has earned for one species the name *pecten-aboriginum* or Indian comb because the Indians used the

fruit to comb their hair.

Habitat: Sonora to Yucatan in Mexico.

Culture: Small collected plants or seedlings require loose soil with leafmold and a reasonably plentiful water supply in warm weather. All species are frost tender and should not be subjected to temperatures below 40 degrees.

Desirability: Seedlings are fairly quick growers under proper conditions and form valuable additions to collections. They make their greatest growth in winter. One seedling made an average growth of over one foot a year.

Uses: Natives find these plants most valuable as they are found in regions where few trees are available for lumber, and the woody cores of the *Pachycereus* and other large-growing cacti are used in the construction of houses and fences.

In seasons of stress the seeds of *Pachycereus* are ground on the grinding stones and are used as a food in the form of cakes called tortillas and in the manufacture of tamales.

Desirable species: *Pachycereus pecten-aboriginum* (Engel.) Br. & R., and *P. pringlei* (S. Watson) Br. & R., seedlings are in plentiful supply, while *P. chrysomallus* (Lem.) Br. & R. and *P. columna-trajani* (Kar.) Br. & R., are available in lesser quantities at somewhat higher prices.

Pachycereus marginatus (D.C.) of Britton and Rose was assigned to the genus *Lemaireocereus* by Berger and more recently by Dr. Werdermann because the flowers and fruit more nearly agree with the requirements of that genus. The scales of the flower tube bear felt but not the bristles of *Pachycereus*, and the fruit is juicy and covered with deciduous spines and do not resemble a chestnut as do fruits of *Pachycereus*.

P. Orcuttii (Brandg.) Br. & R., described as *Cereus Orcuttii* by Mrs. Brandegee in June, 1900, and reported from Rosario, Baja California, Mexico, has not been recollected although extensive search has been made in this vicinity by Howard E. Gates and others on several trips through Lower California.

P. chrysomallus (Lem.) Br. & R., was originally described as a *Pilocereus* because of the woolly apex of flowering plants and many European botanists have assigned it to that genus while others consider it a good *Pachycereus*. In the absence of first-hand knowledge of fruits we

are content to follow Borg in his acceptance of the Rosean classification of *Pachycereus*,

P. Gaumeri Br. & R., is not characteristic of the genus as it is a slender, low shrub. We are fortunately able to present a picture of the spe-

cies in flower at the Knickerbocker Nursery in San Diego, but as this plant did not set fruit and as far as is known the fruit has never been seen, determination of its relationship must await this information.

Genus 11. *Leptocereus* (Berger) Br. & R., 1909.

A genus of tropical, bush-like or occasionally vine-like plants with no aerial roots. The branches are jointed and slender with 3 to 8 ribs and, except in one species (*L. Grantianus* Britton) are heavily armed. The small day-blooming flowers (Fig. 26) are greenish or pinkish and bell-shaped with spiny ovary and flower tube. The fruit is globe-shaped or oblong and more or less spiny.

Habitat: Six or seven species are native to Cuba, one to Santo Domingo, and two to Puerto Rico.

Culture: These tropical plants can only be grown in the tropics or in greenhouses and are always very difficult. Best results have followed the use of a mixture of half sand and half leaf-mold with water supplied sparingly. They are difficult to propagate from cuttings.

Desirable species: Perhaps *Leptocereus quadricostatus* (Bello) Br. & R., and *L. Grantianus* Britton are easiest to cultivate and should be selected by those who want representation of the genus. *L. assurgens* (C. Wright) Br. & R., and *L. Leonii* Br. & R., are available but rare.

RECENT NEW SPECIES SINCE BR. & R.

Leptocereus Grantianus Britton, 1933, Culebra Island, Puerto Rico. Shrubby to 5 feet tall or less, branches 3 to 5 ribbed, the ribs thin and crenate; are-

oles small, felted and bearing 1 to 3 minute, black spines about 1 mm. long, which disappear as the branches age; flowers from areoles near the apex are about 2 inches long, greenish; fruit subglobose to ellipsoid.

L. Ekmanii (Werd.) Knuth, 1931, Cuba. This species has been described but is little known.

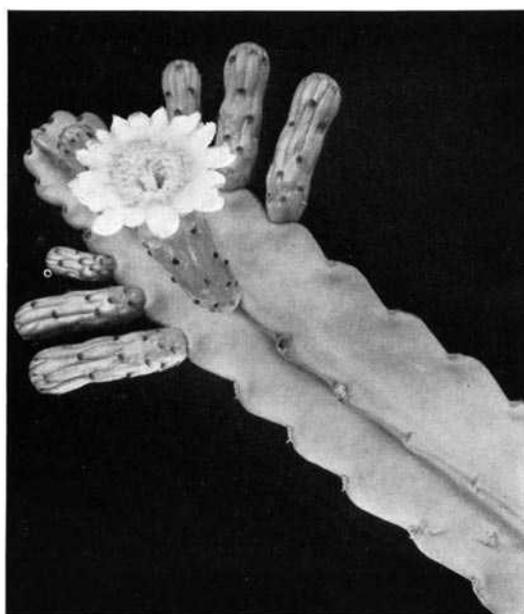


FIG. 26. *Leptocereus Grantianus* Britton x 0.5. Photo by John Poindexter from a plant in the K W. Poindexter Nursery, Compton, California.

Genus 12. *Eulychnia* Philippi, 1860.

A Chilean genus of four species which is just becoming a little known in the United States. The stout stems are erect or procumbent, usually branched and are very spiny and ribbed.

The white or pink flowers open day and night and are short and broad with numerous scales on the ovary and have very short tubes. The axils are filled with bristles or long hairs. The globe-shaped fruit is fleshy and somewhat acid, hardly edible.

Culture: A loose, rich soil is desirable and

water can be supplied freely in growing season. Moderate temperatures are recommended and glasshouse protection in the colder sections.

Desirable species: *Eulychnia iquiquensis* (Schum.) Br. & R., is a very handsome plant in seedling form and is obtainable. *E. spinibarbis* (Otto) Br. & R., is in cultivation here and the seedlings, thus far observed, bear a close resemblance to *Trichocereus coquimbanus* (Molina) Br. & R., with which it may be co-specific if the material available is true.

Genus 13. *Lemaireocereus* Br. & R., 1909.Syn.: *Cereus* Miller, 1754.Syn.: *Stenocereus* Riccobono, 1909.Syn.: *Armatocereus* Backeberg, 1934.

A very interesting group of plants with wide geographical distribution. The plants are usually large, tall and branching but sometimes low and nearly prostrate. About 25 species are known.

The spine-cushions are filled with felt and usually also with stout, numerous spines. Flowers usually bloom by day and are funnel-shaped (Pl. 6: Fig. 11), or bell-shaped and the ovary has more or less nipple-like projections which bear scales; these scales have felt in their axils and as the fruit ripens they develop a cluster of spines. The fruit is globe-shaped or oval and when ripe bursts irregularly, exposing the seeds. When fully ripened, the fruit loses the spines.

Backeberg has erected the genus *Armatocereus* for the species of *Lemaireocereus* from south of the equator, but there is little justification for this separation. The southern species of *Lemaireocereus*, it is true, commonly have the spines continuing to the tube, but this small factor plus the geographical difference does not constitute grounds for the erection of a new genus.

Habitat: From southern Arizona through Mexico and Central America to Peru and Venezuela and in the West Indies.

Culture: The tropical species such as *L. hystrix* (Haw.) Br. & R., *L. humilis* Br. & R., and



FIG. 27 LEFT: Close up of *Lemaireocereus marginatus* x 0.12, FIG. 28. RIGHT: Towering plant photographed in the town of Tehuacan, Puebla, Mexico, near the Garci-Crespo Hotel by W. S. Turnpaugh.

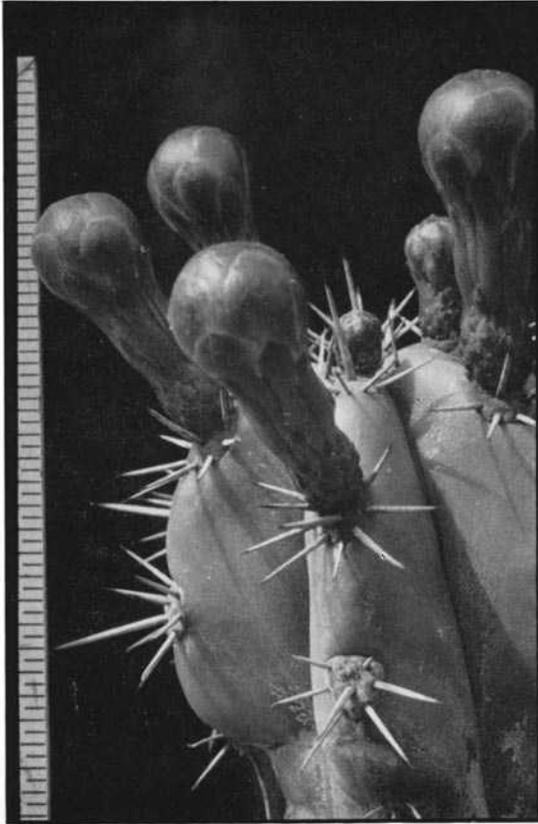


FIG. 29. *Lemaireocereus longispinus* Br. & R., 1920, Guatemala, Published without flower description. Photo by Scott Haselton of exact size buds in the Frank Mark gardens in Los Angeles, California.

L. godingianus Br. & R., require greenhouse care and temperatures in excess of 50° while several of the Mexican species, notably *L. Thurberi* Br. & R., *L. montanus* Br. & R., *L. pruinosus* (Otto) Br. & R., and others can stand temperatures to about 30° if dry. A loose, fairly rich soil mixture and liberal water in warm weather produces best results.

Desirability: All species of this genus have proved desirable and with proper care one is rewarded by excellent growth. Flowers are frequently produced in cultivation.

Uses: The fruits of *L. Thurberi* and *L. montanus* form the most staple diet and favorite food for the natives during fruiting season. The woody structures of many species are used in building, and they are prime favorites as ornamentals in Mexico and the West Indies and doubtless elsewhere.

Desirable species: *Lemaireocereus marginatus* (D.C.) Berg., is easily the most popular member of this genus, and is obtainable as cuttings or seedlings. This plant (Fig. 27, 28) forms a

natural impenetrable fence in its habitat. *L. pruinosus* (Otto) Br. & R., *L. stellatus* (Pfeiff.) Br. & R., *L. Treleasei* (Engel.) Br. & R. *L. Weberi* (Coulter) Br. & R., *L. queretaroensis* (Weber) Safford, *L. montanus* Br. & R., *L. Thurberi* Br. & R., and others are in plentiful supply as cuttings or seedlings and are recommended.

Scarcer but equally desirable are *L. hystrix* (Haw.) Br. & R., *L. godingianus* Br. & R., *L. hollianus* (Weber) Br. & R., *L. chichipe* (Gosselin) Br. & R., *L. chende* (Gosselin) Br. & R., *L. laetus* (H.B.K.) Br. & R., and *L. humilis* Br. & R.

RECENT NEW SPECIES SINCE BR. & R.

Lemaireocereus marginatus (D.C.) Berger is transferred here from *Pachycereus* because its flowers are diurnal, small, and typical of this genus and the fruit is small, edible, and naked when ripened. These facts indicate that its relationship is here. The following varieties of *L. marginatus* are recognized:

Var. *gemmatus* (D.C.). Smaller than the type (about 20 inches high) fewer branches and closely set, oval, white areoles with very few spines.

Var. *incrustedatus* (D.C.). In size comparable to

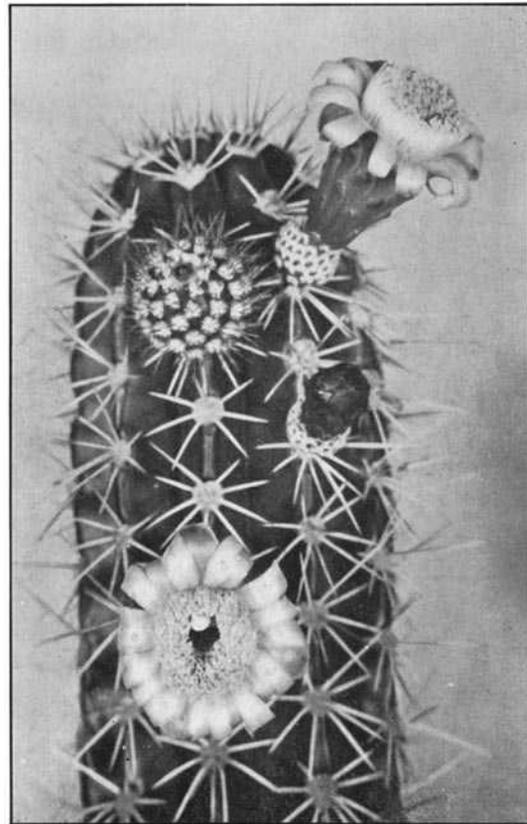


FIG. 30 *Lemaireocereus griseus* (Haw.) Br. & R. x 0.35, in flower and fruit. Photo by F. W. Arnoldo, Curacao.

var. *gemmatus* but has oval areoles with radial spines and a long central spine.

L. matucanensis (Bckbg.) comb. nov. (*Armato-cereus* Bckbg.), Matucana, Peru. This seems to be a mere variety of *L. laetus* (H.B.K.) Br. & R. with a thicker stem and more spread, but may prove a good species when material for study is available.

L. Standleyi Ortega, 1927, Coast of Sinaloa, Mexico, at the mouth of the Quelite and San Lorenzo Rivers. Erect to 12 feet high with a definite trunk and many branches; ribs usually 4 but sometimes only 3, clear green; areoles over an inch apart, elliptical, bearing white felt; radial spines 13 to 16, short; central spines 4 to 8, up to 1 inch long, all spines rose colored in youth, later gray; flowers nocturnal about 3 inches long and less than 2 inches in diameter, from near the top of the branches; ovary green, small, tubercled and scaly; outer perianth segments rosy-green, obtuse, inner perianth segments white; stamens inserted in the upper part of the tube; style longer than the tube,

white; stigma lobes 8, white; fruit spherical, nearly 2 inches in diameter, spiny; pulp red, juicy, edible.

L. Martinezii Ortega, 1929, Mazatlan, Sonora, Mexico. Arborescent to 15 feet high with a definite trunk to 12 inches in diameter; branches beginning 6 feet up, with 9 definite ribs; areoles bearing reddish-brown felt which become black in age; radial spines 7 to 11, short; central spines 3, of which one is as much as 2 inches long; all spines black except the longest central of young areoles which has a red or gray base. Flowers and fruit not studied.

L. Thurberi (Eng.) Br. & R. var. *litteralis* K. Brand., is perhaps worthy of specific rank, as suggested by H. E. Gates, as this more sprawling form is found growing amidst plants of *L. Thurberi* and is always easily distinguished in nature. In cultivation, the plants become similar although the variety always remains smaller.

L. quevedonis Ortega, 1928, west coast of Mexico from Sinaloa to Acapulco, Guerrero. Erect to 15 feet tall with definite trunk and many branches.

Genus 14. *Leocereus* Br. & R., 1920.

A Brazilian genus of 4 species of long and slender-stemmed plants of vine-like habit. The flowers are small and narrowly bell-shaped and the ovary and flower tube have many scales with

numerous silky hairs and bristly spines in their axils. The fruit is small and globe-shaped. *Leocereus* species are not yet available in America.

Genus 15. *Erdisia* Br. & R., 1920.

A genus of slim bushy plants sometimes with most of the plant underground. The stems have few ribs and the areoles are spiny. The flowers are small, red, yellow or scarlet and funnel-bell-shaped (Pl. 6: Fig. 12). The ovary has nipple-like projections with tiny scales which have felt and spines in their axils. The fruit is small, juicy and has clusters of easily detached spines.

Habitat: Peru and Chile.

Culture: Ample space for underground stems is required. Plants will stand temperatures close to freezing but not below. Soil must be loose and heavy in leafmold. Water freely in warm weather.

Desirability: The species in cultivation are attractive and attain greater size than in nature.

Desirable species: *Erdisia squarrosa* (Vaupel) Br. & R., is available and is an attractive plant. *E. Meyenii* Br. & R., is obtainable but rare

RECENT NEW SPECIES SINCE BR. & R.

Erdisia Sextoniana Bckbg., 1935, Mollendo, Peru. Erect, fresh green; ribs 13; 1 inch high; areoles small, round with about 30 golden, gray or brown spines; flower red, 2 inches wide.

FIG. 31. *Erdisia squarrosa* (Vaupel) Br. & R. x 0.4.
Photo by Grahain Heid.



E. maxima is in the trade but I have been unable to find a description of it.

Cereus apiciflorus Vaupel, 1913, may possibly belong to this genus.

Backeberg suggests that *Corryocactus melanotrichus* (Schum.) Br. & R., should be referred to this genus and has so changed it without any particular reason. He says in "Blätter für Kakteenforschung," "I am of the opinion that Rose's *Corryocactus melanotrichus*

is also an *Erdisia*. The characteristics are, spiny tubes and ovaries, the fruit green, spherical, covered with spines, which fall when it is ripe. Color of flower red. The flowers are bell to funnel-shaped, not very large (hence the single red and small-flowered *C. melanotrichus* is also an *Erdisia*)." Rose says the flower is orange and close to the yellow-flowered species of *Corryocactus* and here we would leave it and in this we follow other contemporary writers.

Genus 16. **Bergerocactus** Br. & R., 1909.

The one species in this genus is a low-growing columnar densely spined plant, the spines golden on new stems but becoming brown. In nature, dead stems are surrounded by dying stems and newer growth surrounds them and presents a unique appearance. The bell-shaped, golden flowers are followed by red, juicy fruit covered with golden spines.

Habitat: Southern California, Baja California, and adjacent islands.

Culture: Contrary to popular belief *Bergerocactus Emoryi* wants lots of water after it has become established, which may require a year or more from cuttings. Seedlings are attractive and more easily grown, Tip cuttings grafted on robust *Opuntia* stock produce rapid and colorful growth, and this method of culture is highly recommended.

Desirability: For color, *Bergerocactus* has few equals and for this reason should be a part of all collections.

Uses: The old stems are used for fuel.

Desirable species: *Bergerocactus Emoryi* is in plentiful supply as cuttings, seedlings and grafts.



FIG. 32. *Bergerocactus Emoryi* (Engel.) Br. & R. Habitat photo from Baja California by Wright Pierce.

Genus 17. **Wilcoxia** Br. & R. 1909.

A genus of vine-like cacti with clusters of dahlia-like roots, the stems branched and about the thickness of a lead pencil. The day-blooming flowers are funnel-shaped, red or purple and comparatively large. The ovary and tube as well as the fruit have spines and bristles, or wool in their areoles. About 5 species are known.

Habitat: Southwestern United States and Mexico.

Culture: The large tubers of the roots (Pl. 6: Fig. 13) require ample pot room and should be

planted in loose soil that is not too rich. Water can be supplied sparingly in warm weather. Cuttings can be successfully grown if grafted on stock of *Selenicereus* or *Cereus* seedlings or *Opuntias*, Rooted cuttings have, in some cases, produced the typical tubers of the genus.

Desirability: All species are desirable because of the attractive flowers freely produced on grafted plants, but less freely on Plants on their own roots.

Desirable species: *Wilcoxia Schmollii* Weing.

(sometimes called *W. senilis*), is the prime favorite because of the hair-like covering of the stems, but *W. striata* (Brandg.) Br. & R., *W. Poselgeri* (Lem.) Br. & R., and *W. viperina* (Weber) Br. & R., are in plentiful supply as grafted plants.

RECENT NEW SPECIES SINCE BR. & R.

Wilcoxia Schmollii (Weingart) Knuth 1931, Mexico. Ribs 8 to 10 hidden under a mass of silky, spreading, gray hairs about ½ inch long; flowers purplish to violet.

W. Schmollii var. *nigriseta* has some black hairs mixed with the gray ones.

W. tamaulipensis Werd., 1938, Tamaulipas, Mexico.

W. australis is a name applied to a plant from the west coast of Mexico that seems to be a distinct species, but has not been described as far as we know.



FIG. 33. *Wilcoxia Poselgeri* (Lem.) Br. & R. x 0.3.
From "The Cactaceae" by Britton and Rose.

Genus 18. *Neoevansia* Marshall.

Weber's *Cereus Diguettii* has been recently re-located and it is intermediate between *Wilcoxia* and *Peniocereus* having the dahlia-like tubers and slender, pencil-like stems of the former, but produces nocturnal, white flowers similar to the latter.

Dr. Benson in "The Cacti of Arizona" has referred the species to the genus *Wilcoxia* from which its white, nocturnal flowers exclude it.

We propose a new genus for it, *Neoevansia*, in honor of J. Whitman Evans of Phoenix, Arizona, who rediscovered it and first noticed its divergence from accepted genera.

NEOEVANSIA genus novum Marshall

Plantae perennes ramosae, emergentes e trunco lignoso, ramis gracilibus interdum extensis, costis paucis plus minusve humilibus; radices lignosae longissimae, tuberibus terminalibus plus minusve flaccidis; parvae areolae globosae ellipticae, juniores lanatae, parvis spinis setosis debilibus et mox abeurnibus; magni flores albi vel paululum rosei, nocturni, uno ex areola; ovarium parvum; tubus longus parvis areolis lanatis setosis; parvus fructus coccineus, in forma pyri, multis areolis setosis deciduis, perianthio persistente; parva semina nigra fulgida, tuberculata.

Species typicalis: *Cereus Diguettii* Weber.

In Sonora, Mexico, et in Arizona austro occasu solisque, sub arboribus stirpibusque in planitiebus collibusve provenit. Plantas speciei prope Sonoitann in Sonora (milia passuum novem ad austrum orientem solemque) et ad septentriones in Arizona vidimus. Quidam Mexicani dicunt speciem eandem item prope Magdalenam in Sonora, et in Sinaloa provenire.

Plants bushy, emerging from a woody trunk, with slender, sometimes elongated branches; ribs few, more or less low; roots woody, very long, with more or less flaccid terminal tubers; areoles small, globose or elliptical, young ones lanate; spines small, bristly, weak and soon disappearing; flowers large, nocturnal, white or tinged with pink, only one from an areole; ovary small; tube long, with small, lanate, bristly areoles; fruit small, pyriform, scarlet, with many bristly areoles, deciduous; perianth persistent; seeds small, shining black, tuberculate.

Type species: *Cereus Diguettii* Weber.

Sonora, Mexico, and southeastern Arizona, under trees and shrubs on hills or alluvial bottoms. Mr. Evans says: "I have seen plants of the species nine miles southeast of Sonoita, Sonora, and to the north in Arizona, Certain Mexicans say that the same species grows also near Magdalena, Sonora, and in Sinaloa."

NEOEVANSIA DIGUETTII (Weber) Marshall

Cereus Diguettii Weber in Bulletin du Museum d'Histoire Naturelle. Tome Premier. P. 319, Paris, 1895.



FIG. 34. *Neoevansia Diguetti* (Weber) Marshall. Photo of a herbarium sheet of the type species of genus.

"This *Cereus*, which the natives call "Jaca Matraka," is new and very distinct. I propose to call it *Cereus Diguetti* in honor of the enthusiastic explorer, whose name is so often mentioned in your assemblies. It grows in the sand dunes, into which it thrusts its tuberous, fleshy roots, 30 to 40 cm. long, extending to their conical extremities, similar to a tuft of roots of the Dahlia.

From this tuft it sends out a single branchy, slender stalk, of a dry appearance, resembling shreds of dry wood of a greyish color; the young shoots are of a pale green. These branches have 8 blunt ribs, smooth on the back, separated by narrow grooves; the transverse section of the ribs is almost wedge-shaped, that is to say, broader on top than on the side. The areoles

are 10-12 mm. apart. The spines, of which 10 are radial and 2 are central, are short and appressed, from 1-2 mm. long. According to M. Diguët, the flowers are about 15 cm. long, nocturnal, white; fruit red, slightly spiny, elongated like a pimento; pulp red, slightly acidulous."

The following description was taken from plants collected at the above-mentioned locality near Sonoita, Sonora, by Mr. Evans. These plants are probably the same species described by Weber, but as certain characteristics do not entirely fit the original description, the following description is also given.

Plants bushy, up to ca. 7 dm. high and 4 dm. in diameter, with more or less elongated, branching, slender stems arising from a woody elongated trunk, greyish-green to brownish, becoming woody and dying after the third year, up to ca. 5 dm. long and 8 mm. in diameter; ribs 6 to 9, distinct, up to ca. 2 mm. wide, 0.5 mm. high, separated by pronounced striae ca. 0.5 mm. wide and the same depth; *areoles* 5 to 15 mm. apart, at first slightly white-woolly, rounded, ca. 1 mm. in diameter, later becoming nearly nude, horizontally elliptical to oblong, then rounded and brownish; *spines* ca. 12, appressed to porrect, bristle-like, ca. 4 mm. long, white, tipped with dark brown or black, two of which are central and shorter than the lower radials, all later disappearing; *root system* comprised of up to ca. 50 roots radiating both horizontally and downward from the trunk, with terminal, more or less flabby, elongated, light greyish-brown thin-skinned tubers up to ca. 15 cm. long and 7 cm. in diameter; *flowers* white or tinged with pink, fragrant salverform, s to 9.5 cm. long, 5.5 to 6 cm. in diameter, inner perianths white or slightly tinged with pink, lanceolate to oblanceolate, sometimes apiculate, up to ca. 4 cm. long and 8 mm. wide; outer perianths dark pink to purplish-green, lanceolate or oblanceolate, sometimes apiculate, up to ca. 3 cm. long and 5 mm. wide; sub-outer perianths dark green tinged with purple, narrowly lanceolate, ca. 2 cm. long and 2 mm wide, with long, hairlike bristles up to 2 cm. long in the axils; filaments numerous, white, filiform, up to

ca. 7 cm. long; anthers light lemon yellow, oblong or rectangular, 1.5 to 2 mm. long, 0.5 mm. wide; style yellowish-white, about even with the longest filaments, ca. 6 cm. long, 1 mm. in diameter, glabrous; stigma-lobes ca. 9, whitish-yellow, ca. 3 mm. long; tube up to 4 cm. long, 8 mm. in diameter, greenish, with a few white-woolly rounded areoles ca. 1.5 mm. in diameter, each with a short, bract-like appendage immediately below ca. 1.5 mm. long, with spreading white or black bristles up to ca. 7 mm. long; ovary ca. 1.5 cm. long, 1 cm. wide, dark green, with many white-woolly areoles ca. 1.5 mm. in diameter and ca. 15 bristly spines up to 4 mm. long; fruit pyriform, ca. 4 to 5 cm. long and 2.5 cm. in diameter, bright shiny scarlet, perianth persistent; areoles many, with ca. 15 light colored, bristly, deciduous spines ca. 4 mm. long; *seed* small, shiny black, tuberculate.

Observations: The species flowers during August. The fruits mature during late August and early September, splitting to release the seeds. The native name for the species is Sacamatraca which is also used to identify numerous other plants of the genus *Wilcoxia* and *Peniocereus*. The attractive and tasty fruit is highly prized by the natives as a delicacy. The plants resemble *Wilcoxia* in appearance, but the root system and especially the white nocturnal flowers cannot be satisfactorily accommodated by *Wilcoxia*. Neither can the peculiar root system and fruit with deciduous spines be accommodated by *Peniocereus*.

Superficially the species resembles *Wilcoxia striata* (Brandege) Britton and Rose, which differs from *Neoevansia Diguëtii* in having diurnal, purple flowers and other characteristics.

Culture: As for *Wilcoxia*. *N. Diguëtii* is most successful when grafted on huskier stock.

Genus 19. *Peniocereus* Br. & R., 1909.

A genus of 3 species similar in vine-like habit to *Wilcoxia* but the stems are stouter and usually more angled. The flowers are night-blooming and white and the root-stock is a very large, turnip-shaped organ (Pl. 6: Fig. 14), sometimes weighing from 60 to 125 pounds.

Habitat: Arizona to Texas, Northern Mexico, and Baja California.

Culture: The huge tubers make this plant somewhat of a problem for greenhouse culture, but cuttings grafted on hardy stock are favored by most fanciers. When not grafted, the tubers should be given ample pot room with the upper

portion of the tuber above the ground level, in loose, not too rich soil. Water should be supplied sparingly.

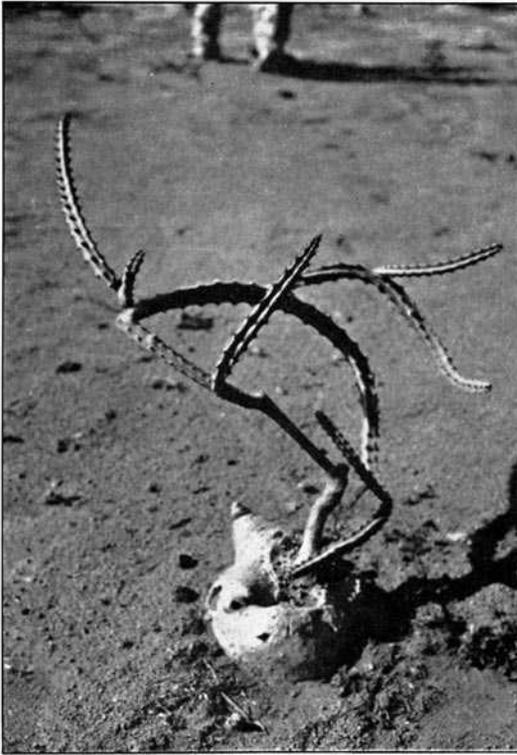
Desirable species: All species deserve a place in collections. *Peniocereus Greggii* (Engel.) Br. & R., is easily obtainable. *P. Johnstonii* Br. & R., (Fig. 36) is also obtainable though rare. *P. Rosei* Ortega, is a handsome plant just coming into collections.

RECENT NEW SPECIES SINCE BR. & R.

Peniocereus Rosei Ortega, 1926, Sinaloa, Mexico. Plant at first erect to 6 feet but the upper branches curved downward; root a conical tuber of die, yellow-



FIG. 35. *Peniocereus Greggii* (Engel.) Br. & R. (*Cereus Greggii* Engel.) in its natural habitat. Courtesy of the Bureau of Plant Industry, U. S. Dept. of Agriculture, Photo by R. K. Peebles.



ish white color and about 4 inches in diameter at the top; branches 10 to 30 inches long and about one-half inch in diameter, at first 4 or 5 ribbed but soon terete, stems a light green spotted with dark green blotches, especially below the areoles; young areoles bear 1 scale, white felt and 2 spines, later 8 or sometimes 9 spines; flowers to 4 inches in diameter; ovary green, tuberculate, scaly and spiny; tube about 2 inches long, whitish-green spotted with red as are the outer perianth segments; inner perianth segments white; stigma lobes cream; fruit red, spiny; pulp red; seeds brown.

FIG. 36. *Peniocereus Johnsonii* Br. & R. x 0.12, Photo by Scott Haselton at Gates' Famous Cactus Gardens, Corona, California.

Genus 20. *Dendrocereus* Br. & R., 1920.

A large tree-like cactus from Cuba and reported from Santo Domingo. The trunk is a large and woody structure and covered with bark while the terminal branches, which form an umbrella-like topping, are dull green and strongly three to five ribbed.

The large, white, night-blooming flowers arise from terminal branches and are called "Flor de Copa" or "cup flower" by the Cubans. The

name *Dendrocereus* means "tree Cereus."

Seedlings of *D. nudiflorus* (Engel.) Br. & R., are now available but still rare; while cuttings can also be obtained, these are less desirable than seedlings. The one species in this genus is tropical and very frost sensitive. It should be kept at temperatures above 50° while the soil for successful growth should be loose and rich.

Genus 21. *Machaerocereus* Br. & R., 1920.

Syn.: *Cereus* 1754.

Syn.: *Lemaireocereus* 1909.

The generic name *Machaerocereus*, meaning "dagger Cereus" gives the clue to one outstanding feature of its two species - their dagger-like spines (Pl. 6: Fig. 15). The plants are prostrate on the ground in the case of *M. eruca* and bushy with long horizontal or prostrate branches in *M. gummosus* (Fig. 37). Flowers are seldom seen in cultivation,

Habitat: Both species are from Baja California.

Culture: Cuttings require a well-drained soil, not too rich. They are slow in rooting and water should be withheld until new roots are formed, then water may be supplied lightly, *M. eruca* roots from the underside of the stem. Seedlings are very satisfactory and are easy to grow in fairly rich soil and will take more water than required by cuttings.

Desirability: Although very shy bloomers in cultivation, the grotesque forms are very accepta-

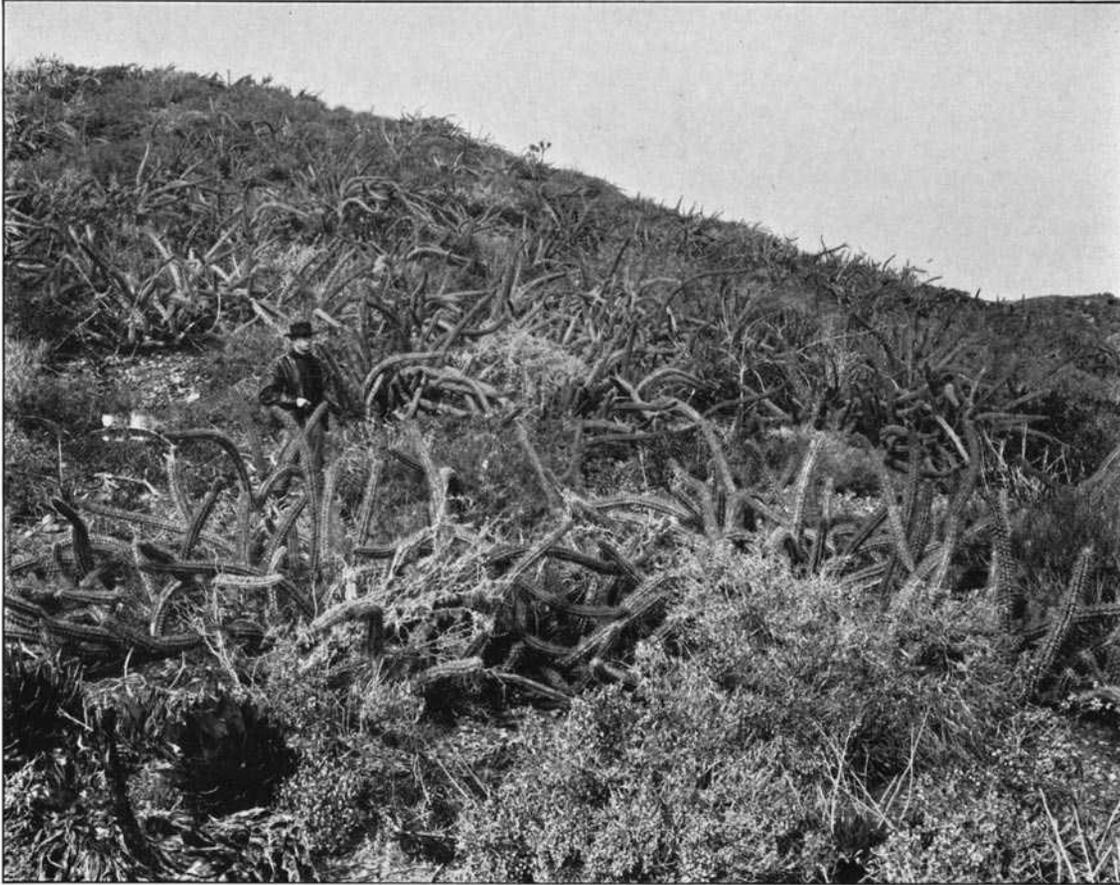


FIG. 37. Habitat photo of *Machaerocereus gummosus* (Engel) Br. & R., in Lower California, Photo by Wright Pierce.

ble in collections. Specimen plants grown outdoors in warmer climates have a tendency to rot easily from any one of a dozen reasons; it is therefore much more desirable to grow a seedling than to lose a specimen plant.

Uses: *M. eruca* (Brand.) Br. & R., called the Creeping Devil, ranks high as an ornamental. *M. gummosus* (Engel.) Br. & R., provides fruits to the markets under the name of

“pitahaya agria.” A fish poison is prepared by bruising the stems into a mashed pulp which is thrown into a running stream. The woody structure is used to supply fire wood.

Desirable species: Cuttings of both species are available but rare. Cristate forms of *M. gummosus* are also available. Seedlings of both species are also in plentiful supply and are very desirable.

Genus 22. *Nyctocereus* (Berger) Br. & R., 1909.

Erect or bending, slender, many-ribbed and sparingly branched, usually spiny and producing large, white night-blooming flowers from which the genus Night Cereus takes its name. Five species are known.

The ovary of the flower bears small scales (Pl. 6: Fig. 16), short or long wool and tufts of weak spines or bristles; the scales and bristles extend

to the lower part of the flower tube, but only lance-shaped scales, which gradually merge into the blunt outer petals, are borne above the middle of the tube. The fruit is fleshy, with scales and spines or bristles.

One species, *Nyctocereus serpentinus* (Lagascas and Rodrigues) Br. & R., Fig. 38, was probably a native of Mexico but is now found there

only in cultivation. It is extensively cultivated throughout the world under the name of Reina de la Noche or Night Blooming Cereus which it shares with numerous other species of many genera.

Habitat: Mexico and Central America.

Culture: *N. serpentinus* does well in a fairly heavy soil and will even stand liberal applications of commercial or barnyard fertilizer and ample water in warm weather. Partial shade is desirable.

Desirability: No collection can afford to be without some representation of this free-flowering genus, and the more species represented the better is the collection.

Uses: As ornamentals, plants of this genus are possibly the most popular of all cacti. *N. serpentinus* is valuable as a grafting stock.

Desirable species: *Nyctocereus serpentinus* is the more common form. The huskier, more erect strain, is sometimes called *N. columnaris* (an undescribed name) and is plentiful and desirable. *N. guatemalensis* Br. & R., is very rare but accordingly most desirable. The other 3 species are not represented in American collections.



FIG. 38. *Nyctocereus serpentinus* (Br. & R.) Br. & R. x 0.15, flowering out of doors at Live Oak Manor, Newhall, California

Genus 23. **Brachycereus** Br. & R., 1920.

A genus of cacti from the Galapagos Islands which is extremely rare in cultivation, there be-

ing but one known species, *B. Thouarsii* (Pl. 6: Fig. 17).

Genus 24. **Acanthocereus** (Berger) Br. & R., 1909.

A genus of wide distribution in semi-arid regions but usually found in river bottom lands that are more or less swampy. They are weak, elongated, many-jointed cacti, at first erect, but soon clambering or trailing, the joints usually three-angled but sometimes with four or five or

more angles, or almost round. Seedlings usually have more ribs and different spines which make them hard to identify. Nine species are known.

The funnel-shaped, night-blooming white flowers are usually large. The flower remains rigid after blooming and then dries on the fruit

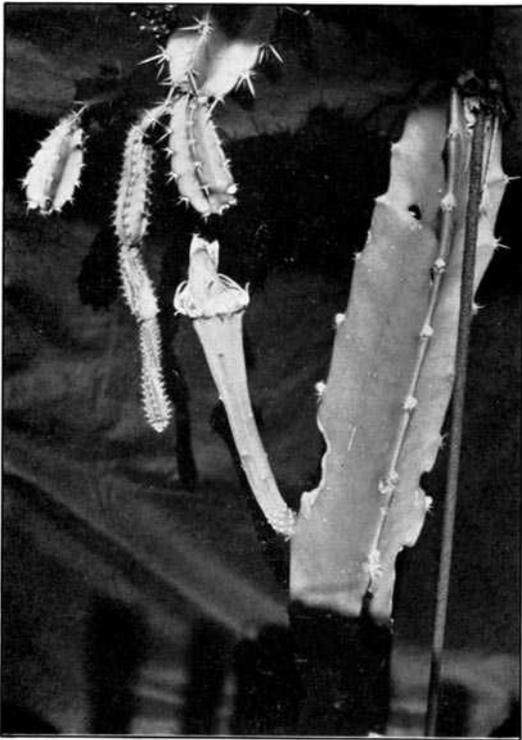


FIG. 39. *Acanthocereus* flower x 0.25, showing the long tube. Photo by Scott Haselton of plant in flower in the F. L. Kennedy gardens in Long Beach, California.

The flower tube is green and expands toward the summit. It bears a few areoles, which carry small scales but no spines. The red fruit is spiny or naked, the thick skin breaking irregularly from top downward when ripe, exposing the stringy red flesh.

Habitat: Texas and Florida, Mexico, Central America, Venezuela, Colombia, and Brazil.

Genus 25. *Arthrocereus* Berger, 1929.

The generic name, *Arthrocereus*, means "jointed *Cereus*" which perfectly describes the type species which is composed of a series of rounded, short joints arising one from another. The flowers are closely allied to *Echinopsis* and are large, white, funnel-shaped, with hairs on the ovary and tube. The tube is very narrow and the style is usually only half as long as the tube. Four species are known.

Habitat: Brazil.

Culture: They do well when grafted on strong stock but under glasshouse culture are satisfactory on their own roots in a loose, rich soil, with water supplied rather freely in growing weather.

Culture: A rich, fairly heavy soil seems most satisfactory and water should be plentifully supplied in warm weather. Propagate by cuttings or from seed. Temperatures below 40° are dangerous.

Uses: Unexcelled as a grafting stock in locations favorable to its growth. Extensively used as an ornamental.

Desirable species: This genus should be well represented in collections, *Acanthocereus pentagonus* (Linn.) Br. & R., is very plentiful, both as cuttings and as seedlings. *A. horridus* Br. & R., and a plant under the undescribed name of *A. hondurensis* which is possibly *A. brasiliensis* Br. & R., are both available and both are beautiful plants with very large flowers. *A. occidentalis* Br. & R., is just coming into the market as is the remarkably beautiful *A. maculatus* Weing., a new discovery.

RECENT NEW SPECIES SINCE BR. & R.

Acanthocereus maculatus Weing., 1933, Guerrero, Mexico. Erect, sparsely branching, up to 6 feet tall, 3 winged, the ribs straight; areoles 2 cm. apart, sparsely velvety; spines small, subulate (P1, D: Fig. 21), brown, 4 radial and 2 central all about 2 mm. long; plant body dark green, spotted with white or lighter green; fruit red and very spiny; seeds black.

A plant widely distributed in the trade under the name of *A. guatemalensis* is actually a robust form of *A. horridus*.

A. Baxaniensis Karw., from Mexico and Cuba, is listed in the trade and was referred to *A. pentagonus* by Britton and Rose but is considered a good species by Borg.

A. acutangulus (Otto), was referred to *A. pentagonus* by Britton and Rose but material received from the New York Botanical Garden makes it referable to *Selenicereus*.

Desirability: Grotesque forms but beautiful flowers.

Desirable species: A rare genus, although *Arthrocereus microsphaericus* (Schum.) Berg., is available in reasonable quantities. *A. Ronsonianus* Bckbg. & Voll., and *A. Campos-Portoi* (Werd.) Bckbg., are rare in collections.

A. mirabilis (Speg.) comb. nov. This species was described in "The Cactaceae," Vol. III: pg. 62, as *Echinopsis mirabilis* and the accompanying illustration well represents the long, very narrow tube of the flower. The style is only half as long as the tube and the plant body is cylindrical, which places it as an *Arthrocereus*.

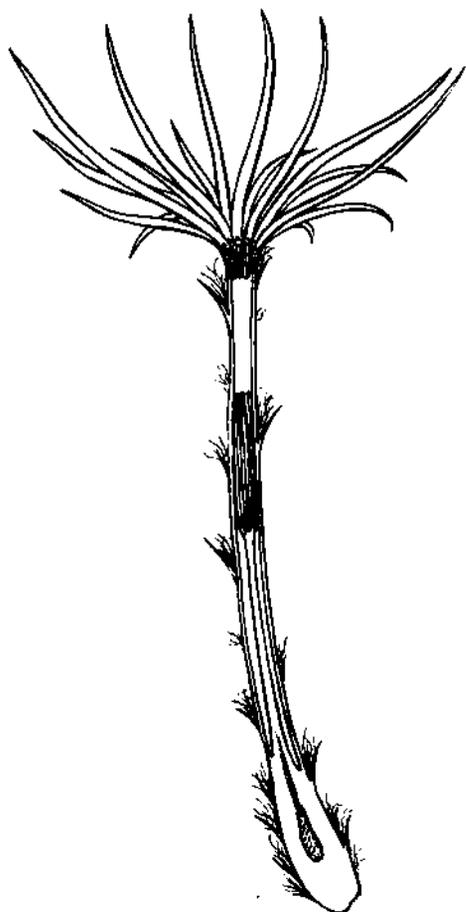


FIG. 40. Cross section of a flower of a typical *Arthrocerus*.
Drawn by T. M. Bock.

RECENT NEW SPECIES SINCE BR. & R

As none of the following species were described in "The Cactaceae" a short description of each is necessary. Only one species was even mentioned by Britton and Rose. On page 159 of Vol. II, *Cereus microsphaericus* Schum., was considered related to *Harrisia*.

Arthrocerus Microsphaericus (Schum.) Berg., 1890, Brazil. (*Cereus Damazioi* Schum.) (*Monvillea Damazioi* Auct.). Prostrate, much branched, the

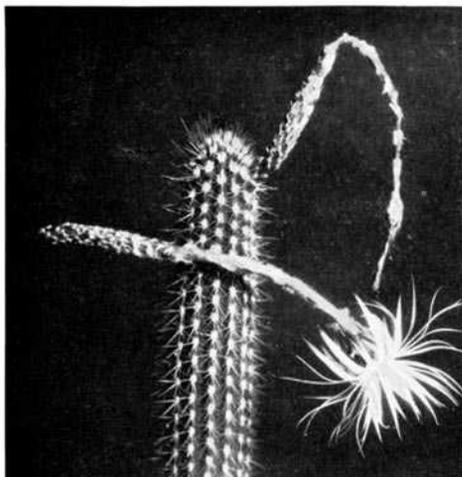


FIG. 41. *Arthrocerus mirabilis* (Speg.) Marshall x 0.25
from Cact. & Succ. Journ. of Amer., Vol. IX: pg. 102.

branches consisting of globular to elliptical joints about an inch long; ribs 8 to 11, areoles very small, approximate (close together), 12 white radial spines and 4 to 12 or more white bristles to an areole; flowers 4 or more inches long, perfumed, funnel-form, white, tube very narrow, style only half as long as tube, petals narrow; fruit globular.

A. Campos-Portoi (Werd.) Bckbg., 1933, Brazil. (*Trichocereus* Werd.). Semi-prostrate, cespitose, joints up to 6 inches long and slightly over an inch in diameter with about 12 low, rounded ribs; areoles approximate, at first with yellowish felt; radial spines 25 to 35, bristly, white, short; central spines 1 or 2 up to nearly 2 inches long; when young all spines are brownish, later all white; flowers about 6 inches long, perfumed, white, tube narrow, style shorter than tube.

A. Rondonianus Bckbg. & Voll., 1935, Brazil. Slender, half erect, branched, up to 20 inches high; areoles with gray felt; approximate; ribs 14 to 18, low, rounded; radial spines 40 to 50, needle-like to bristly, golden yellow, very short or a few up to nearly an inch in length; central spines 1 or 2, nearly 3 inches long; flowers lilac-pink, the tube narrow but the style projects beyond the tube making its relation to this genus doubtful.

Genus 26. *Heliocereus* (Berger) Br. & R., 1909.

Heliocereus (Sun Cereus) is an outstanding genus of plants with large and showy day-blooming scarlet flowers, white in one species. This genus is not to be confused with *Hylocereus* in Sub-tribe III, which is an epiphyte.

The three or four or sometimes seven angled, weak stems are procumbent or climbing over rocks, but in cultivation are sometimes erect. Usually reddish when young, becoming green in age. The flowers are funnel-shaped (Pl. 6: Fig.

18), the tube short but definite and the ovary spiny. The scarlet fruit is edible. There are 6 species.

Habitat: Native to Mexico and Central America.

Culture: Being tropical plants, they will not stand low temperatures. A very rich but porous soil is indicated and water can be plentifully supplied in growing seasons if plants are kept warm.

Desirability: Considered by many as the handsomest flowered cacti, the Heliocerei and the many hybrids between *Heliocereus* and *Epi-phyllum*, *Heliocereus* and *Selenicereus*, are important additions to collections; most of the so-called Orchid Cacti are the result of these crosses.

Uses: These valuable plants not only supply beautiful flowers but produce an edible fruit of

excellent flavor.

Desirable species: *Heliocereus speciosus* (Cav.) Br. & R., is most general in cultivation and is now available both as cuttings and as seedlings. *H. elegantissimus* Br. & R., is rarer but obtainable. A plant frequently offered as *H. Schrankii* has not been positively identified and may prove to be a *Hylocereus* if and when it flowers.

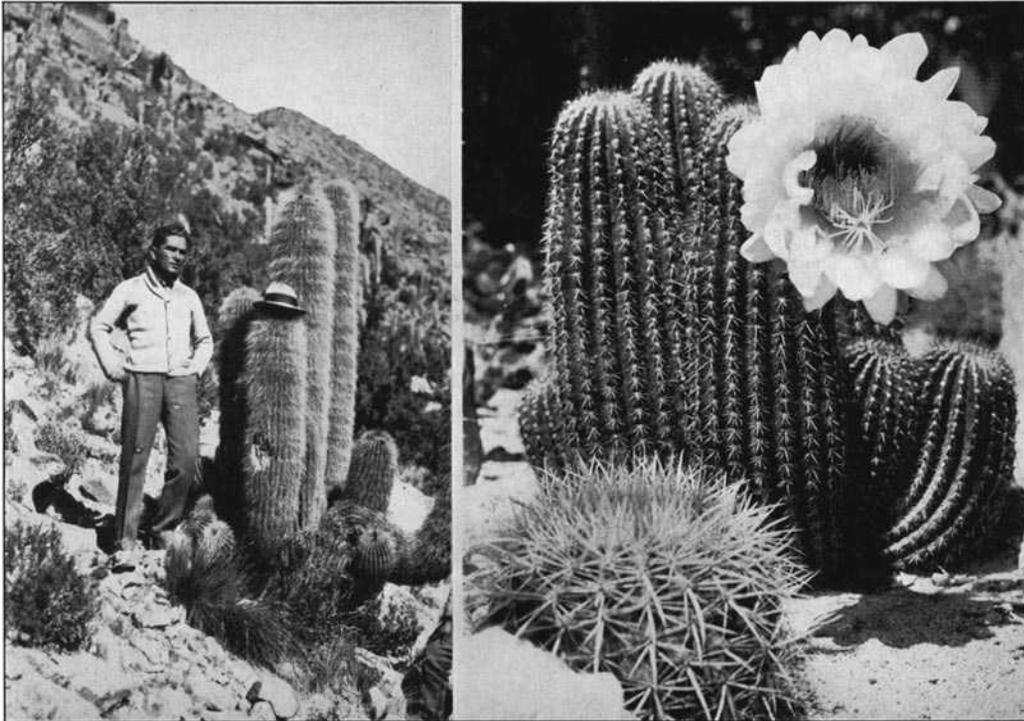


FIG. 42. LEFT: *Trichocereus pasacana* (Weber) Br. & R. Photo by M. Cardenas from Bolivia.

FIG. 43. RIGHT: *Trichocereus Schickendtziizii* (Webez) Br. & R. x 0.15.

Genus 27. *Trichocereus* (Berger) Riccobono, 1909.

The name, meaning "thread *Cereus*" refers to the hairy flower-areoles. About 28 species are known. The genus contains many types of growth habit from the more or less procumbent *T. thelegonus* Br. & R. and the low bushy *T. spachianus* (Lem.) Riccob., to huge trees as *T. Terscheckii* Br. & R., and others. The few to numerous ribs may be low or prominent but are usually very spiny.

The large, white, night-blooming flowers are funnel-shaped (Pl. 7: Fig. 19) and the remains of the flower may fall off or remain on the fruit. The petals are long and the stamens are numerous and thread-like, arranged in two groups on the throat of the flower. The ovary and flower

tube bear numerous scales which have long hairs in their axils. The fruit is without bristles or spines, is dull colored, and usually hairy.

The separation of the genus *Echinopsis* from *Trichocereus* is an arbitrary one and the genera intergrade. Generally speaking, the *Echinopsis* are more distinctly cactoid forms with longer, slimmer flowers, but with the same scaly and hairy flower tubes and fruits.

The yellow-flowered, diurnal *Cereus huascha* does not belong in *Trichocereus* but in the genus *Lobivia* which differs from *Trichocereus* only in its much shorter flowers, yellow to red in color, and which are diurnal.

T. fascicularis with its narrow, reddish-green

flowers and *T. poco*, which is reported to have red flowers, are doubtfully left here pending further information but they do not seem to belong to this genus.

Habitat: In the Andes mountains from Chile and northwestern Argentina through Bolivia and Peru to Ecuador.

Culture: While a soil of quick drainage is essential, it may be composed of relatively large parts of leafmold, and barnyard fertilizers may be used with success. Water can be supplied rather plentifully in warm, growing weather. Easily grown from seeds.

Desirability: The wide range of unique forms and large flowers in this genus of many species makes it an ideal one to select if specialization is planned, or to add interest to a general collection.

T. candicans (Gill.) Br. & R., *T. lamprochlorus* (Lem.) Br. & R., *T. Schickendantzii* (Weber) Br. & R. (Fig. 43), and others are available as seedlings and cuttings in ample quantities. Seedlings of many other species, both old and new, are now available and desirable.

RECENT NEW SPECIES SINCE BR. & R.

Trichocereus auricolor Bckbg., 1935, Argentina, Cylindrical; ribs 16; areoles approximate and bearing yellow felt; radial spines 12, short, acicular; central spines 1 or 2 to ½ inch long; flower unknown.

T. atacamensis Phil., 1860, is listed by Britton and Rose on page 145 of "The Cactaceae," Vol. II, as a possible species of this genus and it has since been collected by Roberto A. Mora F., in Atacama Province, Chile.

T. Bertramianus Bckbg., 1935, Bolivia. Erect to about 5 feet high; stems pale green, clavate; ribs 20;



FIG. 44. *Trichocereus* growing in the high Andes near Santiago, Chile. Photo by Hans Becker.

Uses: In some instances the fruits are edible. The woody portions of the larger-growing species are used both for buildings and as firewood.

Desirable species: *Trichocereus spachianus* (Lem.) Riccob., has beautiful flowers and is widely grown as grafting stock. *T. Bridgesii* (Salm-Dyck) Br. & R., *T. macrogonus* Riccob.,

radial spines 12, about 1 inch long, 4 central spines, one pointing downward; all spines straw-colored; flowers from near the apex; areoles on ovary and flower tube bearing felt and short golden hairs.

T. Bridgesii, (Salm-Dyck) Br. & R. The following varieties are listed:

Var. *brevispinus* Schum. Ribs 7 to 8; spines very short.

Var. *longispinus* Hort. Ribs 4 to 5; central spines very long.

Var. *lageniformis* Först. Stems clavate; ribs 6 or 7; spines numerous, short.

T. cephalomacrostibas Werd. & Bckbg., 1935, Peru to 6 feet high, erect, fresh green; branches 4 inches or more in diameter; ribs about 10; areoles elongated, almost touching, yellowish white, later gray felted; radial spines compressed, radiating; central spine very thick, sometimes twisted; flowers large, white; fruit reddish to orange yellow.

T. chiloensis (Colla) Br. & R. The following varieties are recorded:

Var. *panhoplites* Schum. Young spines almost black, central spine very long.

Var. *eburneus* Schum. Spines white and all spines long; flowers pinkish.

Var. *pycnacanthus* Schum. Spines very short and thick.

Var. *Funkii* Schum. Spines smaller, areoles more closely set, stem light green.

Var. *zizkaanus* Schum. Radial spines small, central spine long, slender, ascending.

Var. *quisco* Weber. Central spines very long, black tipped; stems thick, dark green.

Var. *spinosissimus* Hort. Radial spines 12 centrals 3 or 4, all long, slender, ascending brown to gray.

T. deserticolus (Werd.) Bckbg., 1931, Chile. Branching from base to about 5 feet high, dull green; ribs 8 to 10; areoles ½ inch apart bearing brown felt; radial spines 15 to 20, subulate but long and thin, brown to gray, centrals 1 to 3, up to nearly 5 inches long; flower about 3 inches long, white. This plant is very similar to if not conspecific with *T. coquimbanus*.

T. gladius Schum., is sometimes considered a variety of *T. candicans*, Forming groups of erect or decumbent, cylindrical stems with 9 ribs; radial spines 12, central spine 1, all spines brownish, subulate and tortuous, the centrals up to 4 inches long.

T. litoralis (Johow) Looser, 1921, Chile.

T. poco Bckbg., 1935, Argentina. (Syn: *T. pasacana* var. *albicephala* Herr.: Syn.: *T. cephalopasacana* Bckbg.). Similar to *T. pasacana* and possibly only a variety of it. The plant is smaller than the type of *T. pasacana* and more branched. Areoles on flowering stems thickly covered with wool resembling a pseudo-cephalium.

T. purpureopilosus (Weing.) Bckbg., 1930, Argentina. This species is very near to *T. Schickendantzii* and possibly a variety of it. Erect to about 3 feet high, cespitose; ribs 12; areoles almost approximate, whitish; radial spines about 20; central spines 4 or 5, the radial spines yellow and the centrals yellow with a red base; flowers about 8 inches long, white with a pink flush, the ovary and tube bearing long hairs of a purplish shade.

T. strigosus (Salm-Dyck) Br. & R. The following varieties are recorded:

Var. *intricatus* Weber. Spines long, red with dark tips.

Var. *longispinus* Hort. Spines very long, blood-red when young.

Var. *variegatus* Hort. Spines yellowish or reddish yellow, when young with brown tips.

T. uyupampensis Bckbg., 1935, Peru. Stems slender, slightly over an inch in diameter; ribs 9; areoles small, bearing light-brown felt and 8 to 10 spines all short; flower about 6 inches long, reddish.

T. Vollianus Bckbg., 1935, Bolivia. Similar to *T. spachianus* but of more robust habit; ribs 13, broad; areoles large, bearing 8 to 11 radial spines and 1 central spine, the spines yellowish; flower from near the apex, nearly 5 inches long.

Var. *rubrispinus* has brownish-red spines.

T. Werdermannianus Bckbg., 1935, Bolivia. A gigantic plant which becomes as much as 23 inches in diameter; branches about 6 inches thick with about 6 ribs; the areoles bear felt, 8 radial spines, and 1 central spine. In size this species resembles *T. pasacana*.

Genus 28. *Jasminocereus* Br. & R., 1920. (Pl. 7: Fig. 20.)

This genus from the Galapagos Islands has but one species, *Jasminocereus galapagensis* (Weber) Br. & R., and is so rare in collections

that it may be disregarded for the present. Its principal claim to our interest lies in its discovery by Charles Darwin in 1835.

Genus 29. *Harrisia* Britton, 1908.

Night-blooming with slender branched stems of many ribs and very spiny. The funnel-shaped flowers are large and have a cylindrical, scaly tube as long as the limb or longer. Mostly white, as are nearly all night-flowering species. The flowers are borne near the top of the stem of the

preceding year's growth. The fruits are yellow or orange-red and do not split when ripe. The ten species in this genus are those listed by Britton and Rose under their sub-genus *Euharrisia*, while seven species listed under the sub-genus *Eriocereus* are considered as having generic rank

because of their very different growth habit with fewer ribs, less spines and red fruit which splits when ripe.

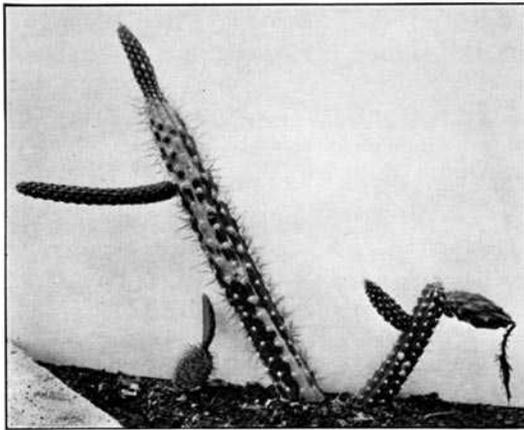


FIG. 45. *Hamsia fimbriata* Britton var. *straminia* var. nov. x 0.1 Note divergent branches. Photo by Grahann Heid.

Habitat: All of the ten or more species come from north of the equator. Florida, the Bahama Islands, Cuba, Hispanola, Porto Rico, and Jamaica are the type localities.

Culture: All are frost tender, and temperatures above 50° are safest. Partial shade, loose but rich soil and plentiful water in warm weather produce best results. Can be grown from seeds or cuttings.

Desirability: Ideal and choice plants for greenhouse culture or out-of-door growth in tropical or sub-tropical countries. Most species flower freely under glass.

Uses: Fruits of some species are eaten.

Desirable species: Both seedlings and cuttings are available of *Harrisia eriophora* (Pfeif.) Br. & R., *H. fragrans* Small, *H. portoricensis* Br. & R., *H. Brookii* Britt., *H. gracilis* (Mill.) Br. & R., *H. Simpsonii* Small, and *H. aboriginum* Small. *H. Earlei* Br. & R., is quite rare.

RECENT NEW SPECIES SINCE, BR. & R.

Harrisia Hurstii sp. nov. Marshall, 1941. Erect with a definite trunk and several strict branches, grayish-green; ribs 10 to 12, very low and rounded and separated by shallow, irregular sulcations; areoles obovoid and small with white felt even in age; radial spines 9, acicular, straw-colored, spreading; central spines 4, cruciform, the lateral ones similar to the radials, the upper one ascending, 2 to 3 inches long, straw-colored with dark chestnut tips, the lower one deflexed, about 1 inch long, straw-colored, slightly darker tipped; flower 8 inches long, funnellform, nocturnal, scales on ovary and lower part of flower

tube triangular, those on the upper part of the tube lanceolate and reddish, gradually passing into the outer perianth segments; outer perianth segments oblong, acute, entire, greenish-white; inner perianth segments oblanceolate, apiculate, somewhat fimbriate, white; filaments greenish-white; anthers dirty-white; pistil greenish-white; stigma lobes 10, spreading, greenish-white; stamens and style included; fruit ovate, lemon-yellow, tuberculate, bearing the persistent perianth, 2 inches long and 1 inch in diameter at the widest part; scales at the apex of the tubercles lanceolate, apiculate, naked in their axils; pulp white, juicy and bearing numerous black, rugose seeds.

Type locality: Monte Cristi, Dominican Republic.

Distribution: Arid sections of Hispanola.

The species is named in honor of Capt. H. E. Hurst of Puerto Plata R.D., who first called it to my attention.

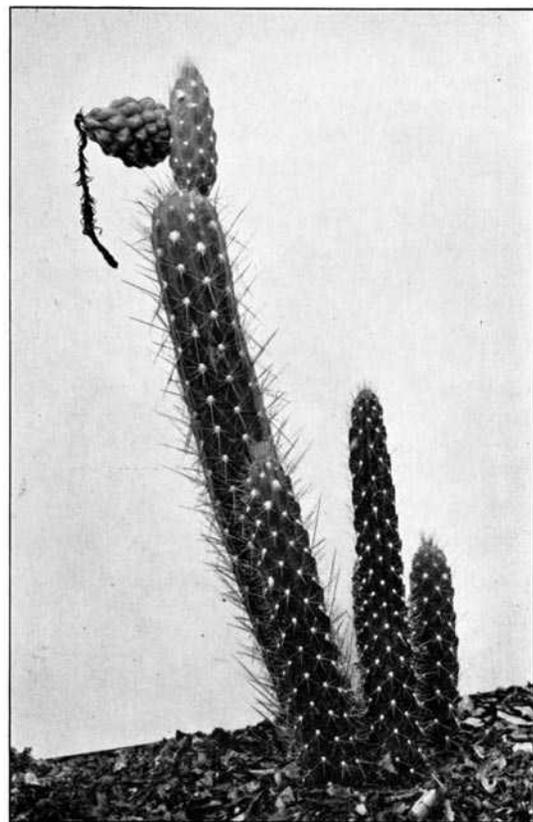


FIG. 46. *Harrisia Hurstii* Marshall sp. nov. x 0.15. Note that branches are strict. Photo by Graham Heid.

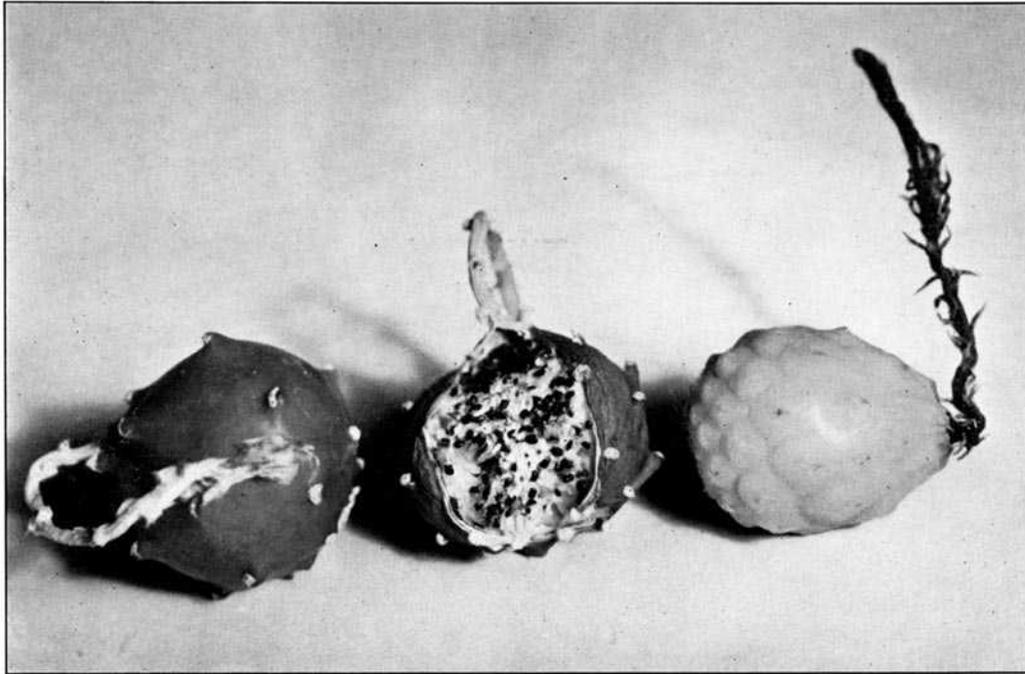
Associated with this species is another *Harrisia* which I will call *H. fimbriata* (Lamarck) Knuth var. *straminia* var. nov. This is a variety of the plant described by Britton and Rose as *H. Nashii* and differs from the type in having 7 radial spines and 4 central spines all straw-colored instead of the 3 to 6 gray spines of the type plant from the western end of Hispanola.

H. Hurstii is distinguished from *H. fimbriata* and its variety by its few strict branches in contradistinction to the many divergent branches of the latter spe-

cies and in its much shorter obovate fruit while *H. fimbriata* has ellipsoid fruit which is at least an inch longer. The flowering period of the species differs by at least a month as reported by Capt. Horst. Associated with the two *Harrisias* is *Pilocereus polygonus* (Lamarck) Br. & R., which in the seedling form closely resembles them in spining and coloration. Later the *Pilocereus* has only short, gray spines and loses all resemblance to the *Harrisias*.

Harrisia Hurstii sp. nov, Marshall

Erectus ad 4 cm. altus, griseo-viridus, apice ramis parvis, ramis strictus; costis 10-12, applanatis-rotundatis; areolis obovatis, albis—lanatis; aculeis marginalibus 9, acicularibus, stramineis, radialibus; aculeis centralibus 4, cruciformis, 5-7 cm. longis, inferioribus minimis, 2-3 cm. longis, stramineis, basi castanea; flore 20 cm. longo; sepalis linearibus, rubro-brunneis; petalis oblongis, acutis integris, viridis-albis; petalis interioribus, fimbriatis, oblanceolatis, albis; seminibus nigris, rugosis.



A. B. C.

FIG. 47. The red, dehiscent fruit of *Eriocereus* (A and B), and the yellow, indehiscent fruit of *Harrisia* (C). Photo x 0.5, by Scott Haselton.

Genus 30. **Eriocereus** Berger.

Syn.: *Cereus* Miller, 1754.

Syn.: *Harrisia* Britton, 1908.

The 11 species here considered constituted the sub-genus *Eriocereus*, of the genus *Harrisia* of Br. & R., but the plants are so different from the true *Harrisias* as to justify complete separation.

The plants are usually vine-like and trailing or procumbent, with fewer ribs than *Harrisias*, fewer spines at the areoles, and usually more robust. The flowers are rather similar to those of *Harrisia* but are larger and expand more widely. The red fruits split irregularly when ripe.

Habitat: All from south of the equator in Argentina, Paraguay, and Brazil.

Culture: Same as for *Harrisia* but the plants do better in cultivation and are much more hardy. Easily grown from seeds or cuttings.

Desirability: Much less frost sensitive than

Harrisia and several species have withstood temperatures of 18° above zero, when dry, without damage. The much larger, and more prolific flowers of many of these species make them valuable additions to collections.

Desirable species: *Eriocereus jusbertyi* (Reb.) Ricco., *E. Bonplandii* (Parm.) Ricco., *E. Guelichii* (Speg.) Berg., are desirable for beauty and number of flowers and are available both as seedlings and as cuttings. The flowers of *E. Guelichii* are light lavender in color. *E. tortuosus* (Forb.) Ricco., *E. Martinii* (Lab.) Ricco., *E. tephacanthus* (Lab.) Berg., and *E. pomanensis* (Weber) Berg., are plentiful. *E. adscendens* (Gürke) Berg., is obtainable but rare. *E. platygonus* (Otto) Ricco., has not been seen here.

RECENT NEW SPECIES SINCE BR. & R.

Eriocereus tephracanthus (Lab.) Berg. (*Roseocereus* Bckbg.), 1853, was referred doubtfully to *Trichocereus macrogonus* (Salm-Dyck) Ricco., but it is not of that relationship- It may be described as follows: Stems simple or very sparsely branched, deep green, 2 or more inches thick; ribs 8, rounded; radial spines about 7, thick and stiff, rather short, whitish with a brown base; central spine one, longer than the radials, brownish at first, later gray; flowers about 7 inches long, greenish-white.

E. tephracanthus var. *boliviensis* Weber. Spines yellow; flowers pure white.

E. jusbertyi Ricco., listed in "The Cactaceae," Vol. II: pg. 158, as possibly belonging here but with the

notation that it is said to be of hybrid origin. Numerous seedlings have been grown here and all are true to type which would seem to prove this to be a good species.

E. Martinii (Lab.) Br. & R. The following varieties are described:

Var. *perviridis* Weing. (*Eriocereus perviridis* Bckbg.), Argentina. Similar to the type but with more slender stems which are longer and a grass green color; the central spine is shorter and the flower is longer with narrower petals than the type.

Var. *Regelii* (Weing.) comb. nov. Marshall, 1941, (*Eriocereus Regelii* Weing.). Similar to the type but with somewhat thicker stems and longer spines. The outer perianth segments of the flower are pale pink but the inner perianth segments are white.

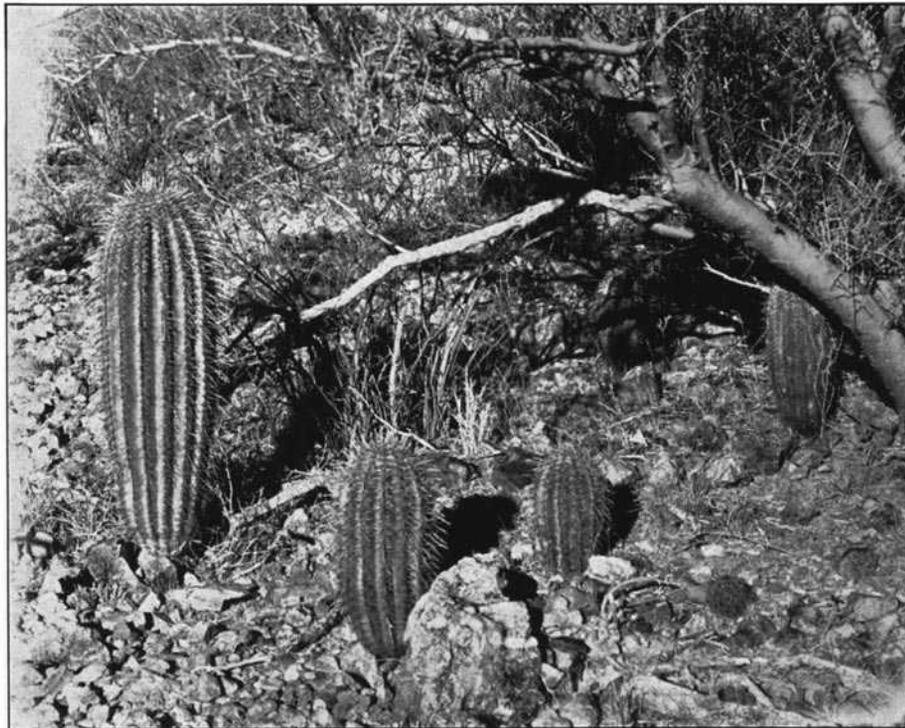


FIG. 48. Seedlings of *Carnegiea gigantea* (Engel.) Br. & R., in their Arizona habitat, x 0.12 Wright Pierce Photo.

Genus 31 . *Carnegiea* Br. & R., 1908.

This genus has but one species, *Carnegiea gigantea* (Engel.) Br. & R., of Arizona and Sonora, Mexico. An immense tree-like plant resembling a *Pachycereus* but differing in that the red fruit is juicy and splits when ripe, thus exposing the red pulp. The fruit is seldom spiny, while the fruit of *Pachycereus* is both spiny and dry. This species has a fairly large, white, nocturnal flower (Pl. 7: Fig. 21), which has been chosen as the state flower of Arizona.

The common name of this plant is "saguaro",

pronounced sa-wha-ro. The fruits are edible and highly prized, not only by the Indians but by local residents who eat the fruit raw or make delicious jelly and candy from it. The central, woody structure resembles a circle of bamboo poles and these remain after the tissue has disintegrated and are then used for rafters by the Indians in building their crude abodes. Interesting seedlings are available but they are very slow-growing and will be unlikely to flower in cultivation.

Genus 32. *Binghamia* Br. & R., 1920.Syn.: *Cereus* Vaupel, 1913.Syn.: *Cephalocereus* Vaupel, 1913.Syn.: *Haageocereus* Werd. St Bckbg., 1934.

Bushy cacti, more or less branched and with many very spiny ribs, the funnel-shaped to bell-shaped, white, nocturnal flowers are produced from the side or apex of the stems, sometimes from very bristly areoles. The flower tube is straight (Pl. 7: Fig. 22), usually stout and the areoles bear a few hairs in the axils of its scales, the ovary is also scaly. Fruit globe-shaped, juicy and crowned by the withering persistent flower remains.

Britton and Rose founded this genus on the species *Binghamia multangularis* (Willd.) 1813, which they first called *B. melanostele* but which they corrected in "The Cactaceae," Vol. IV: pg. 279. Backeberg misunderstood the genus completely and added species with diurnal, red, diagonal flowers from a bristly pseudocephalium, later transferring them to his genus *Seticereus*. Werdermann, who is very sound in his diagnosis, corrected this error and re-established the genus as intended by Britton and Rose.

A genus in Algae was proposed under the name *Binghamia* but this never came into use, thus paralleling the case of the genus *Mammillaria*. Students at the University of California are now reviving this old genus under the name *Binghamiella**

Despite the taxonomic difficulties of the genus, the plants are, without exception, beautiful and worthy of consideration for any collection.

Habitat: Dry Pacific regions of Peru.

Culture: Most species are very slow growers in cultivation but they all do well when grafted on husky *Cereus* stock. When grown on their own roots, a rich, loose soil, heavy in leafmold is best suited to them. If climatic conditions necessitate glasshouse cultivation, the plants should be set out of doors in their pots early in the spring and left out in the air all summer and as late into fall as is safe. Fresh air and sunshine are necessary for healthy growth.

Desirability: The very colorful spining of these species makes them very desirable from an

* *Binghamia* the Alga, versus *Binghamia*, the Cactus. William Albert Setchell and Elmer Yale Dawson, Proceedings of the National Academy of Sciences, Vol. 27, No. 8, pages 376-381, 1941.

ornamental standpoint but they are very shy bloomers in our gardens.

Desirable species: *Binghamia multangularis* (Willd.) Br. & R., is the most attractive of the species. It will be found in dealers' stocks under the names of *Haageocereus melanostele*, *H. pseudomelanostele* or *Pseudoespostoa melanostele*. *B. pacalaensis* Bckbg., *B. acrantha* (Vaupel) Br. & R., *B. chosicensis* Bckbg. and *B. decumbens* (Vaupel) Werd., are available as are a few other species in lesser quantities.

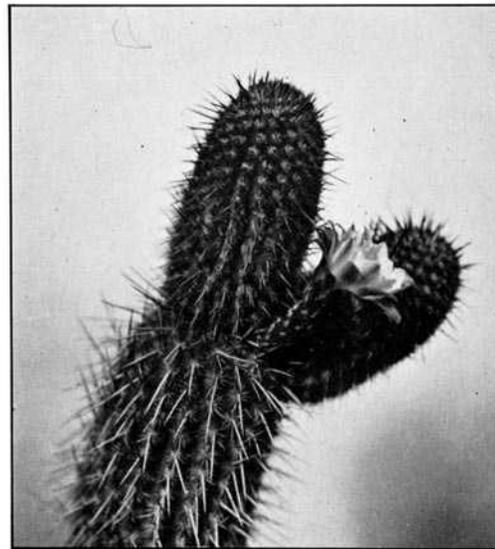


FIG. 48a. *Binghamia australis* (Bckbg.) Werd. x 0.5 flowering in R. W. Kelly's garden.

RECENT NEW SPECIES SINCE BR. & R.

Binghamia australis (Bckbg.) Werd., 1936, Peru. Branched, up to 3 feet high, branches up to 10 inches long and 2 inches thick or more; ribs about 14, low, areoles distant, bearing yellowish felt and 20 fine, long, glassy radial spines; central spines 8 to 12, up to 2 inches long, subulate; flowers white, over 2 inches long, fruit pink. This species resembles *B. decumbens*.

B. chosicensis (Bckbg.) Werd., 1931, Peru. Stems erect, slender, in age sprawling and branching from the base; ribs about 19, low; areoles 1 cm. apart, bearing much yellow wool; radial spines 30 or more, spreading, bristle-like, yellowish with darker tips; central spines 3 to 4 of which one or two are thicker and longer up to an inch long, yellowish-gray with darker tips; flower pale, purplish-red.

B. climaxantha Werd., 1937, Peru, has been described.

B. humifusa (Bckbg.) Werd., 1931. (*Haageocereus versicolor* var. *humifusus* Werd. & Bckbg., 1931). Stems prostrate, grass-green: ribs 12, flat; areoles small; radial spines 10 to 15, light yellow to brown; central spines 1 or 2, long and slender with a dark tip; flower as for *B. versicolor*.

B. laredensis (Bckbg.) Werd., 1935, Peru. Branched, the branches over 2 inches thick with 18 ribs; radial spines 40 to 45, golden, acicular, fairly short. This species is reported to be near *B. chosicensis*.

B. Olowinskianus Bckbg., 1937, Peru, Erect to 3 feet high, stems leaf-green, about 3 inches thick; ribs 13, low; radial spines over 30, stiff, short; central spines 11 to 12, one or two of which are stouter and longer (over 2 inches); areoles oval, closely set, bearing yellowish-white felt; all spines pale at first, then brown and finally gray; flowers over 3 inches long, white.

B. pacalaensis (Bckbg.) Werd., 1935, Peru. Thick, clustering stems, erect and tall, about 2 inches thick with about 15 straight ribs; areoles approximate bearing brown felt; radial spines about 40, acicular, short; central spine 1, up to 2 inches long; flowers pink, opening widely.

B. platinospinus (Werd. & Bckbg.) Bckbg., Peru, 1931. Gray-green to 3 feet long and nearly 3 inches thick with about 13 ribs; areoles bearing grayish felt and 10 to 13 radial spines and 2 to 4 central spines, all brown but becoming gray; flowers nearly 3 inches long; fruit green.

B. versicolor (Werd. & Bckbg.) Bckbg., Peru, 1931. Stiff erect stems up to about 5 feet high and over 3 inches thick, branching from the base; light green with about 12 ribs; areoles closely set and somewhat hairy; radial spines up to 30, straight, very short; central spines 1 or 2, nearly 2 inches long, deflexed; all spines are yellow variegated with reddish zones; flower about 4 inches long with narrow tube and white hairs; fruit roundish, yellow, somewhat hairy. The following varieties are mentioned:

Var. *lasiacantha* Werd. & Bckbg. Radial spines bristle-like, central spines shorter and more spreading.

Var. *xanthacantha* Werd. & Bckbg. stems more erect, with fewer ribs, these less prominent and more notched, central spines up to 1 inch long, lighter yellow.

Var. *humifusa* Werd. & Bckbg. See description of *B. humifusa*.

Genus 33. *Arrojadoa* Br. & R., 1920.

This genus of two species is a most peculiar one, in that the stems produce a head of bristles at the top at flowering time and the small red or pink flowers arise from this bristly head (Pl. 7: Fig. 23). Later the stem continues to grow through the bristles, leaving a collar of bristles around the stem and the ripened fruit appears there. In this habit it resembles the genus *Stephanocereus*, but the flowers and fruit are quite different.

Habitat: Brazil.

Culture: Loose rich soil for seedlings, and not too much water. Species grow well grafted on a husky stock.

Desirable species: *Arrojadoa rhodantha* (Gürke) Br. & R., Fig. 49, available as seedlings. The name, *A. penicillata* (Gürke) Br. & R., is in collections but the plant may be *Eriocereus adscendens* Gürke.

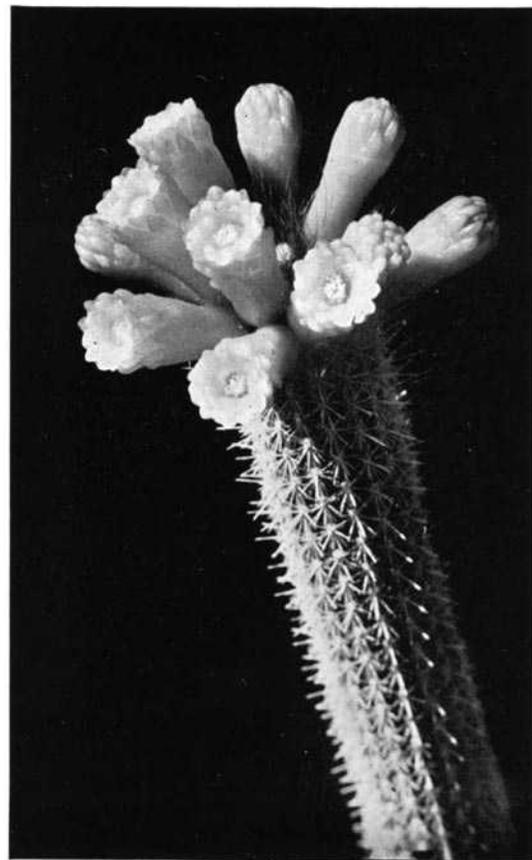


FIG. 49. *Arrojadoa rhodantha* (Gürke) Br. & R. Exact size. Photo by John Poindexter.

Genus 34. *Neoabbottia* Br. & R., 1921.

This genus with its one species, *N. paniculata* (Lamarck) Br. & R., has been collected in Haiti and Santo Domingo within twenty years and the accompanying photograph indicates that it has again been located. It is said to have a

smooth upright trunk and many strongly ribbed or winged branches that are very spiny. The rather small flowers (Pl. 7: Fig. 2.) , are borne several from a single areole in a mass of felt. It has not been in cultivation in the United States.



FIG. 50. *Neoabbottia paniculata* (Lamarck) Br. & R., x 0.03. Habitat photo from Haiti.

Genus 35. **Facheiroa** Br. & R., 1920.Syn.: *Cephalocereus* Gürke, 1908.Syn.: *Trixanthocereus* Bckbg., 1937.

A genus of two species of cacti of bushy habit, the numerous slender stems have many ribs and are very spiny; flowers borne in a cephalium on the side of the stem composed of red or black bristles intermixed with short wool; the white, nocturnal flowers are relatively small and the scales on ovary and flower tube bear long hairs (Pl. 7: Fig. 28); the hairy fruit is less than an inch in diameter.

The genus was erected by Britton and Rose on one species which they thought to be new and described as *F. publiflora*, actually it was a species described by Gürke in 1908 as *Cephalocereus Ulei*.

Habitat: Brazil and Peru.

Culture: These plants require very loose soil rich in leafmold. Water can be freely supplied in growing season. Frost resistance unknown but

safety requires that plants be kept above 40°.

Desirability: Both species are additions to a collection and are very attractive at any stage of growth.

Desirable species: *Facheiroa Ulei* (Gürke) Werd., is obtainable as seedlings and *F. Blossfeldiora* (Werd.) Marshall, is obtainable as cuttings though very rare.

RECENT NEW SPECIES SINCE BR. & R.

Facheiroa Blossfeldiora (Werd.) comb. nova. Marshall (*Trixanthocereus Blossfeldiorum* Bckbg.). Grows 3 feet high, sparsely branched from base; ribs 18 to 25, rounded; areoles closely set, at first with wool and hairs, later naked; radial spines 20 to 25, spreading, acicular, short, straight, glassy; central spines 1, to 1 inch long, porrect, subulate, (See Pl. D) straight, gray with black tips; cephalium about 16 inches long of glassy bristles closely set, red and black, intermixed with white wool.

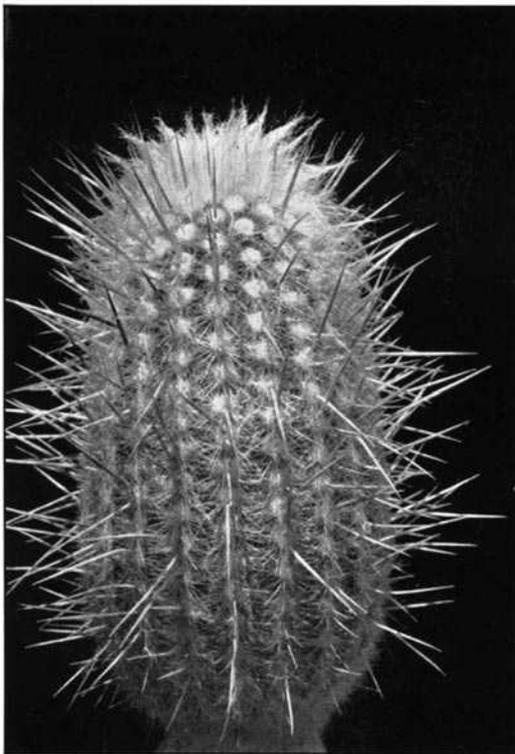
Genus 36. **Espostoa** Br. & R., 1920.Syn.: *Pilocereus* Lemaire, 1839.Syn.: *Pseudoespostoa* Bckbg., 1935.

FIG. 51. *Espostoa lanata* (H.B.K.) Br. & R. x 0.3
Photo by Scott Haselton.

Columnar plants, branching from the base or above, with numerous low ribs and, when flowering, produces a pseudocephalium, similar to that in species of *Pilocereus*, which is nearly terminal in some species, and in others lateral; areoles strongly armed with spines and bearing long white hairs; flowers small, short campanulate, nearly hidden by the surrounding wool, diurnal; scales on ovary and flower tube small, with long silky hairs which last but a short time (Pl. 7: Fig. 27); fruit subglobose to obovoid, smooth, white or reddish, very juicy; seeds dull or polished.

The above is an amended description based on that of Britton and Rose (Vol II: pg. 61) with corrections noted by later observers, one of whom erected the genus *Pseudoespostoa* for plants branching from the base with lateral pseudocephalium and white fruit with shining seeds, species with nearly terminal pseudocephalium, pink fruit and dull seeds were referred to *Espostoa*, thus including some of the factors of the original description in each genus.

We follow more conservative writers such as Borg in uniting these very similar species in one

genus as intended by Britton and Rose when they erected *Espostoa* on the one species they knew, with the notation, "In the Catamayo Valley. . . he collected this species and upon this our description above is largely based. These plants are so different in habit from other plants collected by Dr. Rose in central Peru that we have been very much in doubt whether they should all be referred here or a part separated as a new species."

Habitat: Southern Ecuador and northern and central Peru.

Culture: Loose but rich soil, possibly one part each of sand, top soil, and leafmold. Fairly plentiful watering in warm weather is advisable. Seedlings will not stand low temperatures. Off-sets may be removed and grown from some species, but care must be taken to prevent rot infection to either the parent plant or the off-set.

Uses: The sweet, white or pinkish fruits are edible and highly prized for food.

Desirability: The woolly plant forms are one of the showiest of the ornamentals, and flowers are not required to stimulate interest in this genus. Seedlings are especially attractive as woolly balls of pure white.

Genus 37. *Borzicactus* Riccobono, 1901.

Syn.: *Cereus* Vaupel, 1913.

Syn.: *Cleistocactus* Weber, 1904.

Syn.: *Seticereus* Bckbg., 1937.

Slender, erect or prostrate, the ribs usually numerous, low and rounded. The day blooming, scarlet flowers are of long and narrow construction and are classed as diagonal flowers. Similar flowers are found in the following genera: *Oreocereus*, *Cleistocactus*, *Denmoza*, *Arequipa*, *Matucana*, and *Rathbunia*. The flower tube of *Borzicactus* bears scales (Pl. 8: Fig. 29) and hairs and the small fruits (about the size of a cherry) also bear scales and hairs and are greenish-pink.

Habitat: All of the seven or more species in this genus are from Peru and southern Ecuador and the West Andean region.

Culture: Most species are not very hardy and prefer temperatures over 40°. A well-drained, rich soil is advisable with liberal watering in warm weather.

Desirability: The species seem to flower freely

Desirable species: *Espostoa lanata* (H.B.K.) Br. & R., and *E. Dautwitzii* (Haage jr.) under the name of *E. sericata*, are obtainable in seedling form.

RECENT NEW SPECIES SINCE BR. & R.

Espostoa Dautwitzii Haage jr. (*E. sericata* Bckbg.), is considered by some authorities as a variety of *E. lanata* from which it differs in its more numerous ribs (26 to 30), its yellowish areoles which bear long, yellowish hairs which are numerous at the apex and matted below, its yellow radial spines and reddish central spines.

E. melanostele Borg, (*Cephalocereus* Vaupel, *Binghamia* Br. & R.), Chosica, Peru. Columnar to 6 feet high, branching from below; plant body dark green and covered with close matted white hairs, ribs 18 to 20, low; areoles wide apart bearing 40 to 50 yellow spines, short, acicular but with one central often projecting tip to 2 inches long, in age the spines become black, presenting the appearance of a black column from which habit the specific name is derived; fruit white.

E. melanostele var. *inermis* Bckbg., Matucana, Peru. Central spines not visible through the long white hairs which permit the fresh green of the body to show through.

E. Haagei (Poselg.) Borg, Peru. Columnar, branching at the base, densely matted hairs cover the plant, making a great mass at the apex; spines white or glassy; fruit white, round.

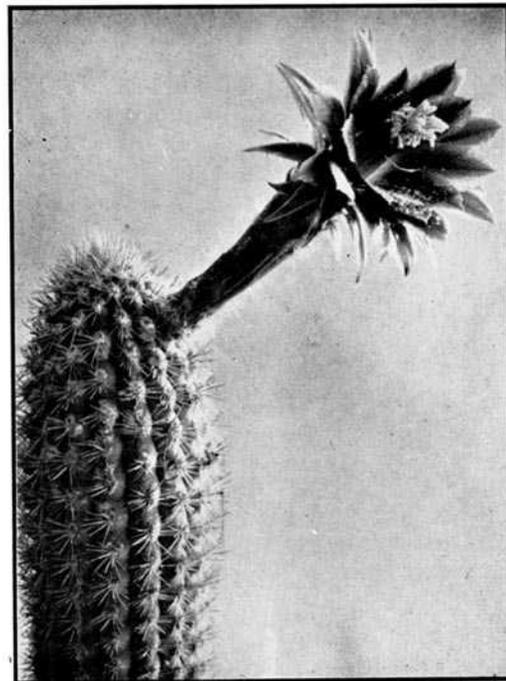


FIG. 52. *Bozicactus acanthurus* (Vaupel) Br. & R. x 0.5

and are exceptionally attractive, but they are quite difficult to obtain.

Desirable species: *Borzicactus sepium* (D.C.) Br. & R., *B. acanthurus* (Vaupel) Br. & R., Fig. 52, and *B. icosagonus* (H.B.K.) Br. & R., are available. All the species of this genus are well worth collecting.

RECENT NEW SPECIES SINCE BR. & R.

Borzicactus decumbens (Vaupel) Br. & R., has been transferred to *Binghamia* by Dr. Werdermann because the flowers are typical of that genus, *B. Humboldtii* (H.B.K.) Br. & R., and *B. plagiostoma* (Vaupel) Br. & R., are found to be identical and are united under the first name, which has precedence.

B. eriotrichus (Werd. & Bckbg.) Bckbg., 1931, Peru. Semi-prostrate and branched up to 16 inches

long, gray-green; ribs about 16; areoles closely set bearing yellow wool and white hairs; radial spines 12 to 15, short; central spines 3 to 6, almost indistinguishable from the radials, all yellowish-white at first, later gray; flowers fiery-red; fruit size of a cherry.

B. jajoianus Bckbg., 1935, Peru. Clustered to 24 inches high, branches over 2 inches thick with 12 ribs; areoles with yellow felt and about 20 radial spines, very short; central spines 1 to 4, subulate, over 2 inches long; flower orange-red.

B. Roezlii (Haage jr.) Bckbg., Bolivia. Erect, branched, fresh-green; ribs 9; areoles elliptic, felted; radial spines 10 to 12, horn-colored, acicular; central spine 1, less than an inch long; flower 2 inches long, red.

Seticereus ferrugineus Bckbg. and *S. Oehmeanus* Bckbg., mentioned in recent literature without place of description, doubtless belong here.



FIG. 53. LEFT: *Oreocereus fossulatus* (Lab.) Br. & R., x 0.2. Photo from R. W. Kelly. FIG. 54. RIGHT: *Oreocereus Celsianus* (Lem.) Br. & R., x 0.25. Photo by Scott Haselton of a grafted plant in his collection.

Genus 38. *Oreocereus* (Berg.) Riccobono, 1909.

Syn.: *Morawetzia* Bckbg., 1936.

A genus of 5 species or more of very handsome plants from the high Andes Mountains of South America. In age they usually form large clusters branching at the base. The erect or ascending stems bear areoles on the ribs and produce long hairs in addition to spines, especially on the top of the plants. The flowers open by day and have slender, cylindrical tubes (Pl. 8:

Fig. 30) and are pink, red or carmine in color. This genus belongs to the oblique-flowered group. The flower tube is covered with slender, pointed scales and is rather hairy. The fruit is round and smooth while the dried flower remains attached. It dehisces (drops its seeds) through an opening in the base of the fruit when ripe.

Habitat: Bolivia, southern Peru, and northern Chile.

Culture: As grafts on a strong *Cereus* stock, they attain maximum beauty but also do well on their own roots as seedling if kept at a temperature of above 40°. Use loose, rich soil with water freely supplied in warm weather.

Desirability: From a spectacular standpoint, these plants are very desirable and as they are comparatively easy to grow, though rather slow, they deserve a prominent place in collections. They are very attractive as seedlings.

Desirable species: *Oreocereus celsianus* (Lem.) Riccob. Fig. 54, with its varieties, and *O. fossulatus* (Lab.) Bckbg., are available and most satisfactory. *O. Trollii* (Kupper) Bckbg., is the handsomest but certainly the slowest in growth, and is also available, *O. Hendricksonianus* Bckbg., is available but more rare.

RECENT NEW SPECIES SINCE BR. & R.

When this genus was accepted by Britton and Rose, they assigned to it but one species, *O. Celsianus* (Lem.) Riccob. and included in the synonymy Haage's *Pilocereus Bruennowii* which we now know to be a variety of *O. Celsianus*, and Labouret's *Pilocereus fossulatus* which we now recognize as a very distinct species. As the description of *O. Celsianus* in "The Cactaceae" is a compound of the descriptions of former authors, we give herewith a more accurate one:

Oreocereus Celsianus (Lem.) Ricco., 1850, Bolivia. Erect to 15 feet or more; branches erect or ascending to more than 6 inches in diameter; ribs 10 to 17, dark green or grayish-green; areoles large, oval and bearing white wool and silky, white hairs; radial spines about 9, yellowish-brown; central spines 1 to 4, longer and thicker than the radials; flowers from near the top of the plant, nearly 4 inches long, reddish.

O. Celsianus var. *Bruennowii* Schum. Stems more slender and with but 9 to 10 ribs; the hairs from the areoles matted; brownish; central spines dark brown.

O. Doelzianus (Bckbg.) Borg., 1936, Peru. (*Morawetzia Doelziana* Bckbg.). Forming groups to 3 feet high of slender, dark yellowish green stems, about 3 inches in diameter, clavate; ribs 11, low and broad; areoles distant, round, bearing gray felt and a few silky, white hairs in young areoles; radial spines about 20 or fewer; central spines 4, cruciform, up to 1½ inches long, all spines yellow to dark brown; flowers from the apex of the stem, 4 inches long, carmine; fruit ovate, yellowish-green. This species was assigned to the genus *Morawetzia* by Backeberg because of the apical position of the flower, which, however, is only slightly more marked in this species. He also speaks of a cephalium from which the flower arises but, again, this massing of silky hairs is only slightly more than

is usual in other species of this genus.

O. fossulatus (Lab.) Bckbg., 1855. Erect to 6 or more feet high; branches about 3 inches in diameter with 9 to 14 ribs, dark green; radial spines 14, single central spine 2 inches long, transparent yellow as is the upper and strongest radial spine; the hairs are long and silky, not matted; flower 4 inches long, red.

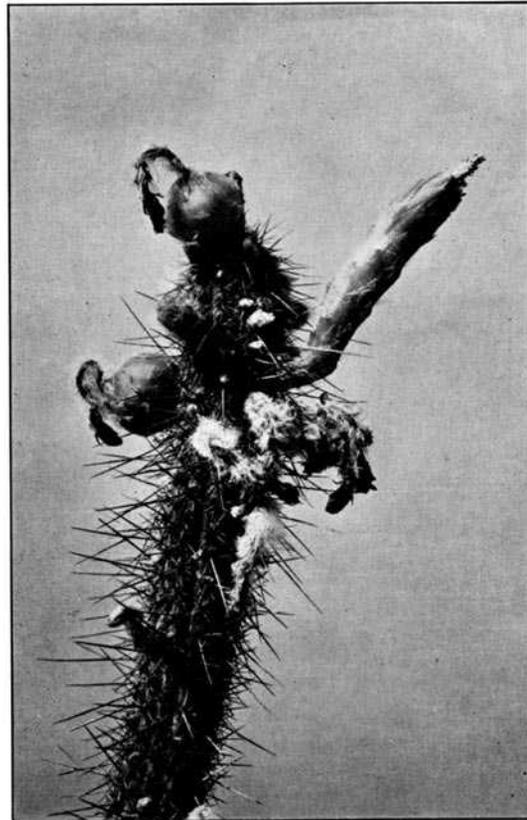


FIG. 55. *Cleisocactus Baumannii* Lem. x 0.5, showing flowers and fruit. Photo by Scott Haselton.

O. fossulatus var. *lanuginosior*. Hairs more abundant.

O. Hendricksonianus Bckbg., 1935, Peru. Cespitose to 4 feet high; ribs 10, flat and broad; areoles bearing yellow felt and numerous shining, yellow, silky, hairs; radial spines 8 or 9; central spines 1 to 4, horn-colored, the longest nearly 3 inches long; flower reddish; fruit yellowish.

O. Trollii (Kupper) Bckbg., 1929, (*O. Irigoyenii* Fric nom. nud.) also sometimes spelled *Trollei*, Bolivia and Argentina. Simple or branched from the base; about 2 feet high, light green; ribs 10 to 25; areoles large, oval, distant, filled with light gray wool and numerous hairs, at first silky and creamy-white becoming woolly and dirty-white; radial spines about 15; centrals 1 to 3 heavier and longer; all spines at first reddish-brown becoming waxy-white; flowers rose colored.

Genus 39. *Cleistocactus* Lemaire, 1851.

Another genus with red, diurnal flowers. The name *Cleistocactus* is from the Greek meaning "Closed cactus" referring to the flower which does not expand at the end (Pl. 8: Fig. 31). There are 12 known species. Slender, erect or clambering with numerous ribs and the spine-cushions on the ribs set close together, usually bearing numerous spines. The orange-yellow, orange-red to scarlet flowers (in one species green-tipped) occur near the top on the sides of the stem and are numerous on most species. The ovary and flower tube bear numerous appressed scales with hair or long wool in their axils. The fruit is small, globe-shaped, red to orange-yellow becoming smooth when ripe.

Habitat: From Paraguay and northern Argentina to Central Bolivia.

Culture: These fairly frost-resistant plants have withstood temperatures as low as 28° without damage to many of the species. They require rich, loose soil and ample water in warm weather.

Desirability: Valuable additions to any collection and suitable for use in any garden, even though no other cacti are included.

Desirable species: *Cleistocactus Strausii* (Heese) Bckbg., is a very handsome plant but rather tender and not so free blooming as other species. *C. Baumannii* Lem., *C. smaragdiflorus* (Weber) Br. & R. (green tipped flower), *C. areolatus* (Muhl.) Ricco., *C. tupizensis* (Vaupel) Bckbg., and *C. Herzogianus* Bckbg., are available in the trade. *C. Buchtieni* Bckbg., and *C. Morawetzianus* Bckbg. are rare.

RECENT NEW SPECIES SINCE BR. & R.

Britton and Rose knew but three species of *Cleistocactus* when Vol. II of "The Cactaceae" was published but described *C. areolatus* as a possible species of *Harrisia* on page 159 of that volume. Since the publication of "The Cactaceae", several other species of *Cleistocactus* have been discovered. *Cereus serpens* H. B. K., was described on page 163 of Volume II, and *Pilocereus Strausii* Heese, which was included in the synonymy of *Oreocereus celsianus*, have been determined as referable to *Cleistocactus*. Other species now known to be *Cleistocactus* were mentioned. We therefore have descriptions of the following species in "The Cactaceae": *C. Baumannii* Lem., *C. smaragdi-*

florus (Weber) Br. & R., *C. anguinus* (Gürke) Br. & R., *C. serpens* (H.B.K.) Weber, Vol. II: pg. 163, as a possible *Borzicactus*, *C. areolatus* (Muhl.) Ricco., Vol. II: pg. 159, as a possible *Harrisia*, *C. hyalacanthus* (Schum.) Goss., Vol. II: pg. 176, as a possible *Cleistocactus*, *C. tupizensis* Vaupel, Vol. II: Appendix pg. 226. The last two named species are recognized by some botanists while others consider them as mere varieties of *C. Strausii*.

Knuth lists *Cereus tarijensis* mentioned in Vol. II, Appendix, pg. 226, as possibly of this relationship.

The following are new varieties of *Cleistocactus Baumannii*:

Var. *colubrinus*. Thicker stems of a dark green color; areoles dark brown as are the spines; flowers larger, not so freely produced; stems sometimes procumbent.

Var. *flavispinus*. Stems more slender, all spines pale yellow, 1 to 3 from each areole directed upward, nearly 2 inches long.

Var. *Grosiei*. Paraguay. Yellow spines and pink flowers.

C. Buchtieni Bckbg., 1935, Bolivia. (Sometimes considered as a variety of *C. Herzogianus* Bckbg.). More or less erect, branching, 2 inches thick; ribs 18 with V-shaped markings over the small areoles which bear brown felt; radial spines about 12, acicular; central spines 4 up to an inch or longer; all spines reddish-brown; flower slightly over 2 inches long, wine-red.

C. Herzogianus Bckbg., 1934, Bolivia. Erect to 6 feet high; about 2 inches thick, gray-green; ribs about 11, radial spines about 8, very short; central spine 1, nearly an inch long, not always present; all spines, straw-colored: flower about one inch long, bright red; greenish pistil projecting; fruit pinkish-orange.

C. Morawetzianus Bckbg., 1936, Peru. Much branched bushes to 6 feet high, gray-green; from the oval felted areoles, the spines are at first golden, later whitish-gray with straw-colored tips, 7 to 10, of which 1 is central and longer than the others; flowers 2 inches long, slightly bent, white inside with greenish tinge; pistil far projecting.

C. Strausii (Heese) Bckbg., 1907, Bolivia and Argentina. Erect, slender, branching from the base, light green; ribs about 25, narrow; areoles small, far apart, bearing white wool and 30 or more hair-like white spines; central spines 4, pale yellow, sometimes almost 2 inches long; flowers from near the top of the stem, 3 or more inches long, red, only slightly curved.

C. Strausii var. *jujuyensis* Bckbg., 1935. Central spines golden to brown.

An unnamed variety with glassy-white spines is known.

C. tominensis (Weing.) Bckbg., 1931, Bolivia. Erect to 6 feet high and 2 inches thick; ribs 18 to 22; areoles round; radial spines 8 to 9, ½ inch long; central spines 3; flower 1 inch long, light red,

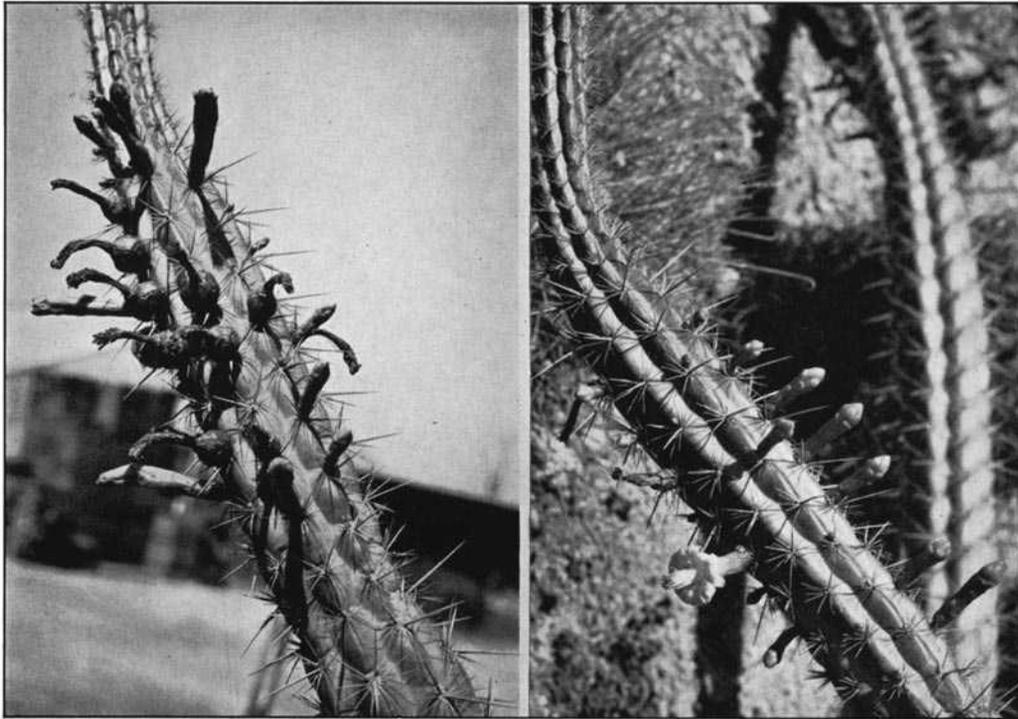


FIG. 56. *Rathbunia sonorensis* Br. & R. x 0.17, showing flowers and fruit of a plant grown by R. W. Poindexter. Photo by Scott Haselton.

Genus 40. *Rathbunia* Br. & R., 1901.

This genus of two or three species is from the west coast of Mexico. In growth, habit, and appearance they resemble *Machaerocereus gummosus* but the flowers (Pl. 8: Fig. 32) are scarlet and diurnal. In northern Sonora, it is a husky plant of four inches or more in diameter but in southern Sonora it is much smaller and weaker and seldom exceeds two inches in diameter. The plant is at first erect but later the stems grow longer, bend and often touch the ground where they root and again start an erect growth.

Habitat: West Coast of Mexico in Sonora, Sinaloa, Mayarit, and Colima.

Culture: Seedlings or cuttings do well in loose soil of moderate richness and can use considerable water in warm weather. They stand temperatures down to freezing.

Uses: The pulp of the fruit is sweet, and edible. Old wood is excellent for camp fires.

Desirable species: *Rathbunia alamosensis* is usually applied to the weaker plant, and *R. sonorensis* to the more robust northern variety, but they may be conspecific. Both are available in seedlings and cuttings. *R. Kerberi* has recently been collected by Edgar Baxter in Sinaloa near Mazatlan, Mexico.

Genus 41. *Zehntnerella* Br. & R. 1920.

Another genus from Brazil with but one species, *Z. squamulosa*. It is a tall, slender, much-branched plant with numerous ribs and these

very spiny. The flowers (Pl. 8: Fig. 33) are said to be very small and perhaps night-blooming. It is just coming into collections as seedlings.

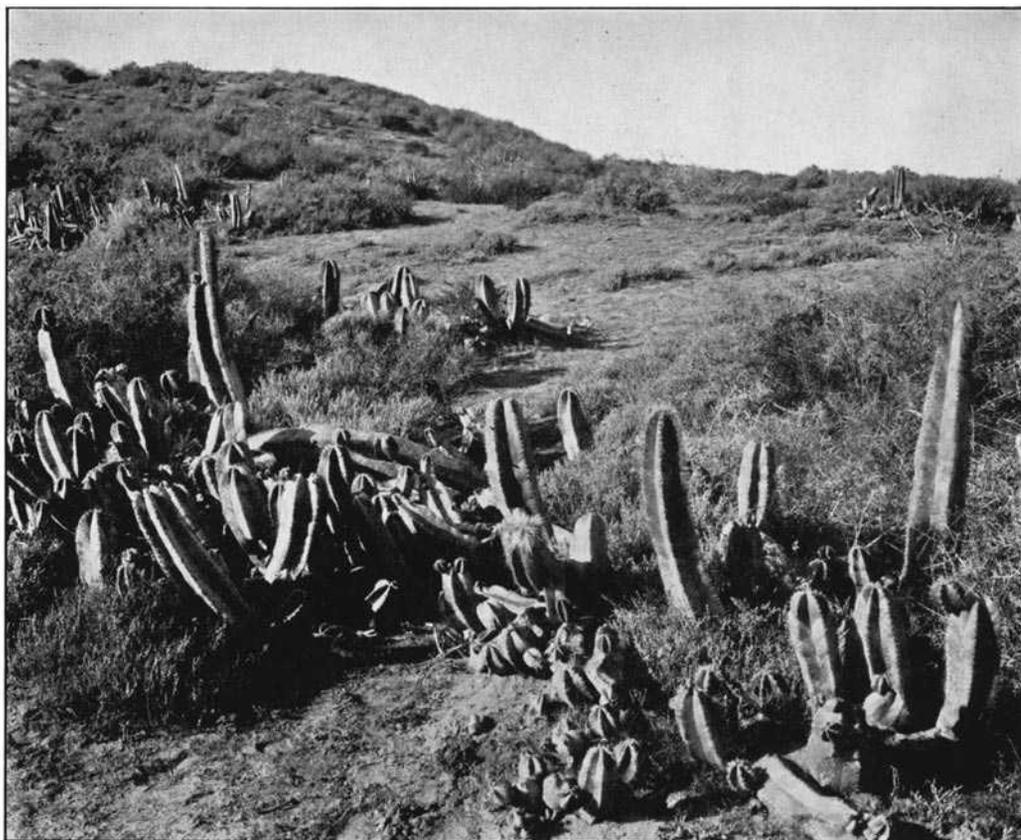


FIG. 57. Habitat photo of *Lophocereus Schottii* (Engel.) Br. & R. Photo by Wright Pierce.

Genus 42. *Lophocereus* (Berger) Br. & R., 1901

A genus of stout columnar cacti, sometimes bushy or sometimes making a tree with a definite trunk.

It is outstanding because of its habit of producing numerous long bristles (Fig. 58) from all the areoles on all the ribs of flowering branches in distinction to the few, heavy spines on the rest of the plant. It has the additional characteristic of producing two or more flowers from a single spine-cushion—a characteristic shared only by *Myrtillocactus*, *Neoraimondia*, and one genus in ECHINOCACTANAE.

Habitat: Baja California, Sonora, Mexico, and rare in southern Arizona.

Culture: A mixture of one-third sand, one-third leafmold, and one-third top soil, with some gypsum and charcoal has proved most satisfactory. Water frequently but sparingly in warm weather.

Desirability: Highly ornamental, One or

more species should be included in every collection. The monstrous form, commonly called the Totem Pole Cactus, is especially desirable.

Uses: Planted as hedges in Mexico.

Desirable species: *Lophocereus Schottii* (Engel.) Br. & R., is considered as the more robust of the species; this base-branching form comes from the northern part of its range. *L. Sargentianus* (Orcutt) Br. & R., is slimmer in its stem and usually lower and more bush-like, *L. australis* (Brand.) Br. & R., forms trees with definite trunks. *L. Gatesii* Jones, Cact. & Succ. Journ. of Amer., Vol. V: pg. 546, has many more ribs and the bristles on the flowering ribs are more robust and less numerous than in the other species. All four species are available as cuttings or seedlings. *L. Schottii monstrosus* is a real plant novelty; this seems to be identical with a plant offered in Germany as *Cereus mieckleyanus*.

Knuth calls attention to the habit of *Pilocereus scoparius* Poselger, 1853, during and after flowering. In its habit it is identical with the genus *Lophocereus* and if it produces more than one flower to an areole it should be referred here. This is a matter for further study.



FIG. 58. Flowering branch of *Lophocereus Schottii* (Engel.) Br. & R. x 0.2 (*Cereus Schottii* Engel.). Courtesy Bureau of Plant Industry, U. S. Dept. of Agriculture.
Photo by R. H. Peebles.

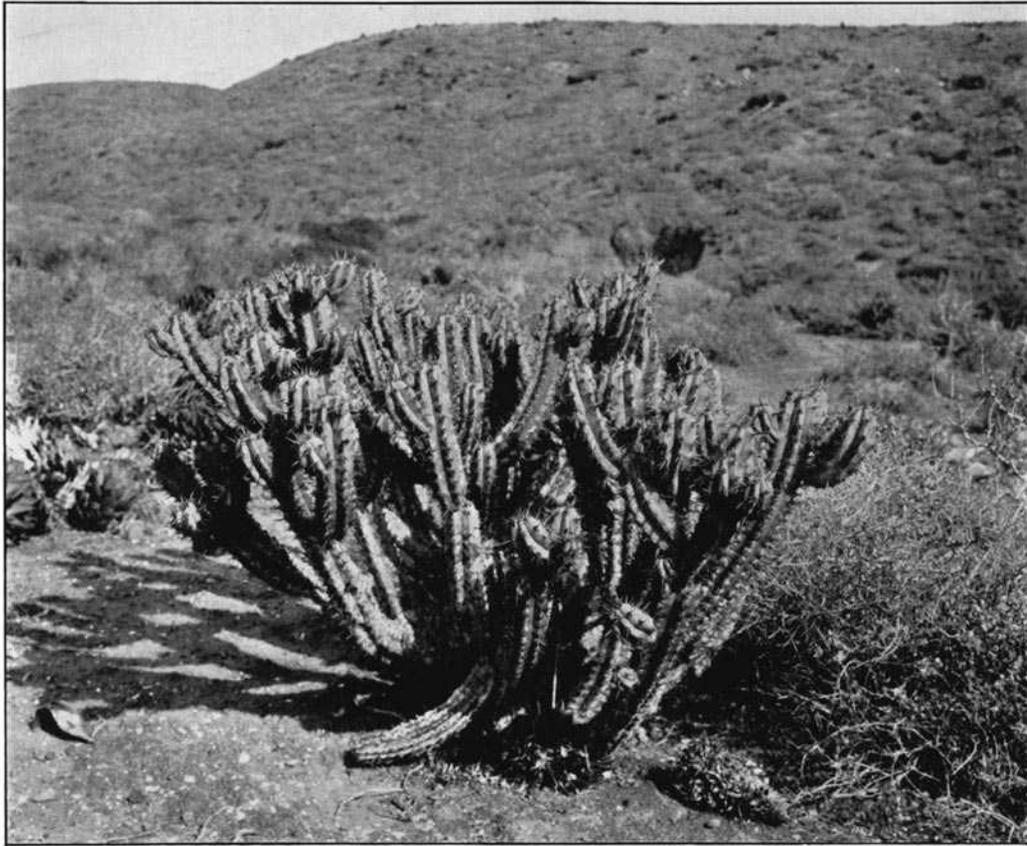


FIG. 59. Habitat photo of *mytillocactus geometrizans* Mart. var. *cochal* Orcutt. Photo by Wright Pierce.

Genus 43. *Mytillocactus* Console, 1897.

A genus of large, tree-like cacti with short trunks and numerous branches which are nearly erect and have but few ribs. Spines are usually stout and awl-shaped. The small flowers (Pl. 8: Fig. 35) somewhat resemble those of orange trees, arising two or more from one spine-cushion and flowers are produced prolifically in cultivation. The fruits somewhat resemble bluish or purplish gooseberries and are edible.

About four species are known, all bearing a very close resemblance to each other and but few fanciers can definitely identify cuttings of any species.

Habitat: Mexico and Guatemala.

Culture: Heat seems to be the answer to quick growth of *Mytillocacti*. Plants in gardens at Palm Springs on the California desert respond to the intense heat with unbelievable growth while specimens in the coastal regions are rather slow. A loose, not too rich soil with ample water in very warm weather is desirable. Temperatures

should be kept above 50°.

Desirability: Where there are facilities to keep temperatures high enough, one or more species of *Mytillocactus* makes an attractive addition.

Uses: The fruits, either fresh or dried, are in demand in the markets of Mexico where they are called "Garambulla."

Desirable species: *Mytillocactus cochal* Brand., from Baja California, or *M. geometrizans* Mart., from the tablelands of the mainland of Mexico, are available in cuttings or seedling form. Many botanists consider these species as identical, an opinion in which we concur. They could be written *M. geometrizans* and *M. geometrizans* var. *cochal*. *M. Schenckii* Br. & R., is rarer but available as seedlings *M. Eichlamii* Br. & R., is rare also.

M. grandiareolatus Bravo has, since its publication, been returned to *M. geometrizans* by Miss Bravo who now considers it a mere form of the older species.

Genus 44. *Neoraimondia* Br. & R., 1920.

This outstanding genus from western Peru consists of columnar, robust plants with numerous, erect branches from the base. It has but few ribs but these produce, from their areoles, perhaps the longest of cactus spines-sometimes ten inches long. The areoles produce flowers year after year and these spine-cushions, which are always enormous (Pl. 8: Fig. 36), sometimes elongate, branch, and produce a most remark-

able appearance not found elsewhere.

One or two of the relatively small flowers are borne at one areole followed by the small, woolly and spiny fruit.

N. macrostibas (Schum.) Br. & R., the only species, is rare but obtainable as seedlings and if grafted on strong stock, grows rapidly.

The self-explanatory varieties, *rosiflora* and *gigantea*, both by Backeberg, are recorded.

Sub-tribe 2. *Hylocereanae*Genus 1. *Hylocereus* (Berger) Br. & R., 1909. Pl. 9: Fig. 1.

This genus of climbing cacti is of ten epiphytic, that is, growing on trees without ground connection but not taking sustenance from the host tree. It has long, three-winged stems with roots from

the sides of the stems above the ground which are called aerial roots (Pl. 4: Fig. 2); the areoles bear a tuft of wool and several short spines; flowers very large, blooming at night; the ovary



FIG. 60. *Hylocereus undatus* (Haw.) Br. & R. x 0.15 grown by Mrs. Helen Morris, La Jolla, Calif. Photo by Thos. H. Wells. Courtesy Lane Publishing Co.

and flower tube are covered with leaf-like scales which give the bud the appearance of an artichoke; the flowers are white, or reported as red in two species, funnel-shaped and bear numerous stamens on the throat. The fruit is spineless but bears scales and bursts irregularly when ripe. Seventeen species are known.

Habitat: West Indies, Mexico, Central America and South America. All are tropical or sub-tropical.

Culture: A very rich soil composed of one-half leaf-mold, one-fourth top soil, and one-fourth sand is recommended. Greenhouse protection is practically necessary as the plants will not stand cold. Plenty of water should be supplied in growing weather. They grow rapidly from seed.

Desirability: Those equipped to grow *Hylocerei* will find them most desirable for unique form and for their very beautiful flowers which are freely produced when plants are properly grown. They are often seen in glasshouses climbing over extensive areas and flowering profusely with but little root attachment.

Uses: Used as ornamentals very generally and as hedge plants in the tropics; the half-mile hedge of *H. undatus* (Haw.) Br. & R., about Punahou College, Honolulu, is said to produce five thousand flowers in a single night. The fruit is used for food and highly prized. Plants of various species of this genus bear the much abused common name of "Night-blooming *Cereus*."

Desirable species: *Hylocereus undatus* (Haw.) Br. & R., Fig. 60, is most plentiful and is very desirable. *H. monacanthus* (Lem.) Br. & R., and *H. triangularis* (Linn.) Br. & R., are much rarer but obtainable. All have green stems and white flowers. *H. stenopterus* (Web.) Br. & R., and *H. extensus* (Salm-Dyck) Br. & R. the red flowering species, are very rare, if obtainable at all. *H. bronxensis* Br. & R., *H. polyrhizus* (Web.) Br. & R., *H. venezuelensis* Br. & R., and *H. costaricensis* (Web.) Br. & R., are less frequently found in collections but are attractive because of the whitish powder on the stems and because of their large white flowers.

Genus 2. *Wilmattea* Br. & R., 1920.



A genus of one species, *Wilmattea minutiflora* Br. & R., from Guatemala and Honduras which resembles *Hylocereus* in growth habit, but has much smaller flowers (Pl. 9: Fig. 2). The joints are triangular, slender and have air roots. The leaf-like scales on the ovary and flower tube bear felt in their axils and sometimes one or more bristles. The species is fairly plentiful in cultivation where it flowers freely.

FIG. 61. *Wilmattea minutiflora* Br. & R. x 0.5. Graham Heid photo.

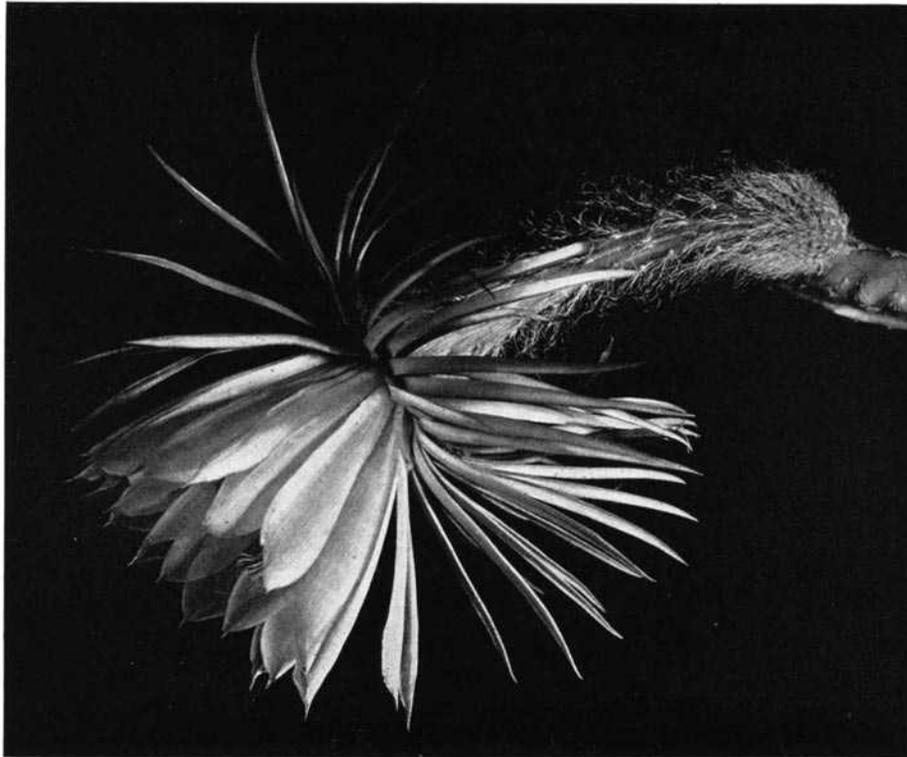


FIG. 62. *Selenicereus pteranthus* (L. & O.) Br. & R. x 0.4 from the garden of R. E. Willis. Photo by H. Wm. Menke.

Genus 3. *Selenicereus* (Berger) Br. & R., 1909.

Another vine-like, climbing cactus sometimes epiphytic on trees and having air roots. The stems, however, are usually slender and ribbed or angled irregularly; the areoles are sometimes elevated on small knobs and bear small spines or are sometimes spineless. The large flowers bloom at night, are white and the ovary and flower tube bear small scales, usually with long felt, hairs, and bristles in their axils (Pl. 9: Fig. 3). The large, reddish fruit is covered with clusters of spines, bristles and hairs. About 23 species are known.

Habitat: Southern Texas, Mexico, West Indies, Central America, and South America.

Culture: While more hardy than *Hylocereus*, there are but few of the species that will stand very low temperatures and a minimum of 40° is safest. Soil and treatment same as for *Hylocereus*.

Desirability: Producing some of the largest and showiest of the cactus flowers, many of which are termed "Night-blooming Cereus," this

group cannot be overlooked by fanciers.

Uses: Highly prized as ornamentals. From the stems of *Selenicereus grandiflorus* (Linn.) Br. & R., is prepared a heart medicine which is in very general use.

Desirable species: *Selenicereus grandiflorus* (Linn.) Br. & R., is most desirable of the species, but is comparatively rare in collections, although plants with that name are frequently seen. *S. Macdonaldiae* (Hook.) Br. & R., and *S. pteranthus* (Link & Otto) Br. & R., (the latter some times under the name *S. nyctacaulis*), are most common in collections and very desirable. *S. Urbanianus* (Gürke & Weing.) Br. & R., *S. coniflorus* (Weing.) Br. & R., *S. Donkelaeri* (Salm Dyck) Br. & R., *S. Knuthianus* (Otto) Br. & R., *S. brevispinus* Br. & R., *S. Boeckmannii* (Otto) Br. & R., *S. hamatus* (Shied.) Br. & R. (sometimes as *S. rostratus*), *S. vagans* (Brand.) Br. & R., *S. Murrillii*, Br. & R., *S. spinulosus* (D.C.) Br. & R., and *S. Wercklei* (Web.) Br. & R., are rarer but obtainable.

RECENT NEW SPECIES SINCE BR. & R.

Selenicereus Nelsonii Weing., Mexico. Ribs 6 or 7, repand (wavy), tuberculate; areoles small with white wool; spines 10 to 12, of which 1 to 3 are central, short, white or yellow; areoles on ovary and flower tube bearing white wool and white bristles; outer perianth segments linear, acute (Pl. F: Fig. 6); inner perianth segments large, lanceolate, apiculate, white; stamens white; pistil long, white; fruit red, spiny.

S. Pringlei Rose, West Coast of Mexico. This species was at first thought to be distinct but later was referred to *S. coniflorus* by Britton and Rose. Material recently collected in Sinaloa by Edgar Baxter seems to indicate that Borg is correct in his conclusion that the plant of the west coast referred to this species is distinct from either *S. coniflorus* or *S. vagans*. It has more and thinner ribs than either of those species and is more heavily armed. The flower is said to be shorter than flowers of *S. coniflorus* and longer than those of *S. vagans*.

S. Vaupelii (Weing.) Borg, Haiti. This species was referred to *S. Boeckmannii* by Britton and Rose but is certainly distinct, as recognized by Borg. In ribbing and spining they are similar although they can be distinguished from a distance in their habitat even when not in flower; at flowering time there can be no possible doubt as the flowers of *S. Boeckmannii* have a powerful perfume reminiscent of Easter lilies while those of *S. Vaupelii* have an equally powerful perfume, of a strong vanilla odor.

A plant in cultivation under the name of *S. pseudospinosus* seems to be very distinct from *S. spinulosus*, the flowers are white and perfumed and the stem is strongly armed while *S. spinulosus* is much less stron-

gly armed and the flowers are a pale orchid color.

S. Rothii (Weing.) Berg., Paraguay, seems to be a form of *S. Macdonaldiae* with a yellowish flower and *S. Grusonianus* (Weing.) Berg., is a Mexican form of the same plant.



FIG. 63. *Selenicereus Murrillii* Br. & R. x 0.3. Photo by R. S. Woods, taken in his garden in Azusa, Calif., at 8 a. m., as the flower was closing.

Genus 4. *Mediocactus* Br. & R., 1920.

An epiphytic cactus, usually growing in trees and resembling the *Hylocereus* type of growth, but with rather heavier stems which frequently have a reddish or brownish color. The funnel-shaped, night-blooming flowers (Pl. 10: Fig. 4), are shaped more like those of *Selenicereus* but lack the hairs of that genus while the

fruit resembles that of *Selenicereus* but is more knobby.

Of the two known species only *M. coccineus* (Salm-Dyck) Br. & R., is in cultivation and is sometimes found under the synonym, *M. Hassleri*. *M. megalanthus* (Schum.) Br. & R., is the species not in collections.

Genus 5. *Deamia* Br. & R., 1920.

The one species of this genus resembles *Hylocereus* in growth habit except that sometimes the stems are five to eight ribbed or winged instead of three winged. The day blooming flowers are very large, funnel-shaped (Pl. 10: Fig. 5), yellowish-white, and the very small scales on the

ovary and flower tube bear three to five long brown bristles in their axils. Native to the tropics from southern Mexico to Colombia, it is extremely tender and should be grown only under glass using the same soil mixture as for *Hylocereus*. *D. testudo* (Kar.) Br. & R., is rare.

Genus 6. **Weberocereus** Br. & R., 1909.

A genus of 3 *Hylocereus*-like plants, the flowers of which are small, pink to rose-colored or white, night-blooming and short funnel-shaped (Pl. 10: Fig. 7). The ovary and lower part of the tube bear weak hairs while the upper part of the tube bears a few leaf-like scales. The ovary, and later the bristly fruit, are covered with nipple-like projections.

Habitat: Panama and Costa Rica.

Culture: Temperatures above 50° and in rich

but loose soil. Water freely in the growing season

Desirability: Plants of this genus are interesting to studious collectors but do not justify the necessary care from those who want showy plants or large flowers.

Desirable species: *Weberocereus panamensis* Br. & R., is the species most often seen in collections while *W. tunilla* (Web.) Br. & R., and *W. Biolleyi* (Web.) Br. & R., are rare.

Genus 7. **Werckleocereus** Br. & R., 1909.

Resembling *Hylocereus* in growth habit but with medium sized, white, funnel-shaped flowers (Pl. 10: Fig. 6); the ovary and tube bear very tiny scales which have several nearly black, needle-like spines and short black felt in their axils. The globe-shaped fruit is spiny. Two species are known.

Habitat: Costa Rica and Guatemala.

Culture: As for *Hylocereus*.

Desirability: In greenhouses with proper care, flowers are freely produced making very attractive showings.

Desirable species: *Werckleocereus Tonduzii* (Web.) Br. & R., is not often found in collections, while the only other species, *W. glaber* (Eich.) Br. & R., is rare.

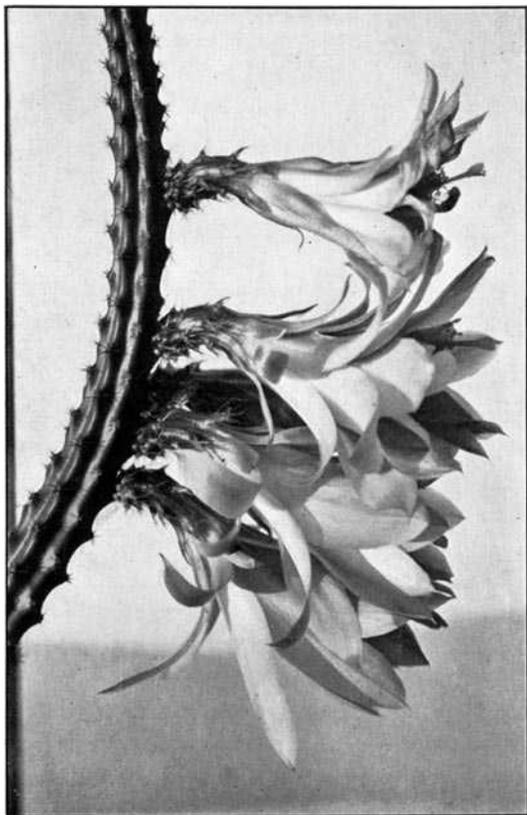
Genus 8. **Aporocactus** Lemaire, 1860.

FIG. 64. *Aporocactus martianus* (Zucc.) Br. & R.
Photo by Scott Haselton in the author's garden.

Slender, whip-like cacti, creeping, clambering or trailing. Aerial roots freely produced. The day-blooming, short funnel-shaped flowers (Pl. 10: Fig. 8), are pink to red and are of peculiar structure. The globe-shaped fruit is red and hairy. Five species are known.

Habitat: Mexico and possibly South America.

Culture: Usually grown as a hanging pot-plant either in greenhouses or on porches, in which event they are taken inside the house for the winter. They like very rich soil that may be fairly heavy, and will take lots of water in growing weather. They do well grafted on *Nyctocereus* or strong *Selenicereus* stock, and are sometimes trained over a framework and arranged like an umbrella.

Desirability: The attractive and numerous flowers make the plants desirable to all flower lovers. They have been cultivated for more than one hundred years and are commonly called Rat-Tail Cactus.

Desirable species: *Aporocactus flagelliformis* (Zucc.) Lem., is the species most usually seen, but *A. flagelliformis* (Zucc.) Lem., *A. leptophis* (D.C.) Br. & R., and *A. Conzattii* Br. & R., are in collections. *A. martianus* (Zucc.) Br. & R., is a somewhat stouter plant than the others with larger flowers but more difficult to grow; it is obtainable.

Genus 9. **Strophocactus** Br. & R., 1913.

A little known Mexican genus whose one species, *Strophocactus Wittii*, produces flat, leaf-like stems which attach to the bark of a tree, usually spiraling around the tree trunk to which

they are attached by aerial roots. The very large flowers (Pl. 10: Fig. 9), resemble those of the genus *Selenicereus*. Not known to be in cultivation.

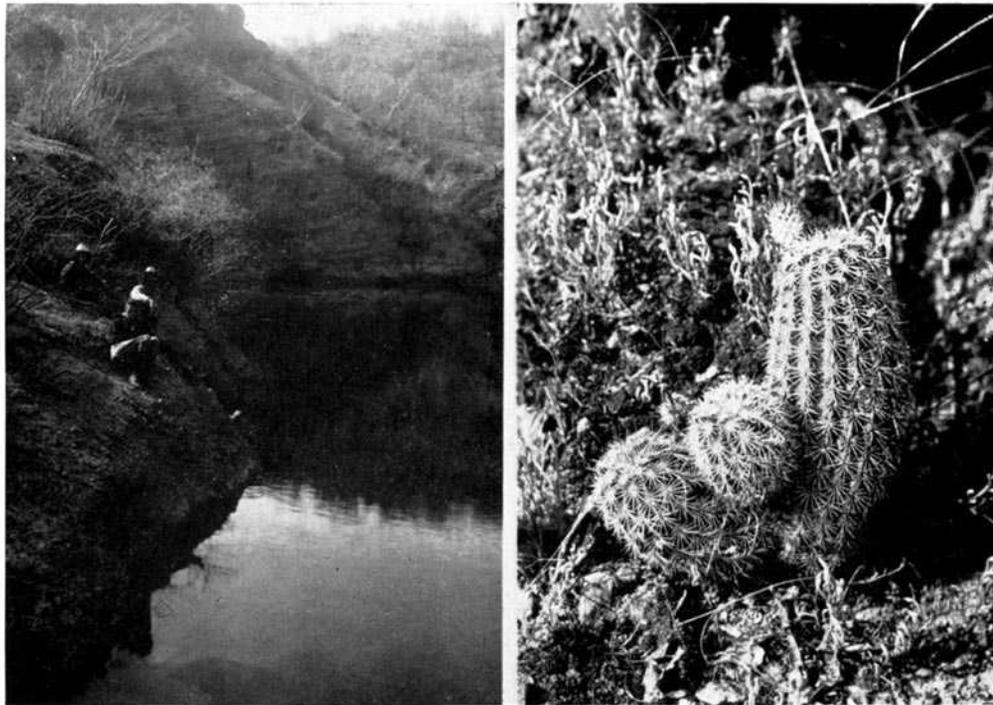


FIG. 65. LEFT: Type locality of *Echinocereus Bristolii* Marshall. FIG. 66. RIGHT: *Echinocereus Bristolii* Marshall x 0.33

Sub-tribe 3. **Echinocereanae**Genus 1. **Echinocereus** Engelm., 1848.

A popular and interesting genus remarkable for the unusually large, day-blooming flowers. The plants are always low, either erect or prostrate, sometimes pendent over rocks, stems sometimes single, sometimes clustered, globe-shaped to cylinder-shaped, and usually very spiny.

The flowers are bell-shaped (Pl. 11: Fig. 1) or short funnel-shaped and colored scarlet, crimson, purple, yellow, white, or brownish green. The ovary and flower tube are always spiny and the stigma lobes are usually green. The fruit is thin-skinned, colorful and spiny and frequently edible, the spines detaching easily.

Britton and Rose have listed 60 species in this genus but recent students of the genus, including Dr. Elzada U. Clover of the University of Michigan, Dr. R. W. Poindexter and Mr. Graham Heid, all of whom have made extensive collecting trips through California, Arizona, New

Mexico and Texas, find that many of the species intergrade to such an extent that it is impossible to say that a given species ends or starts at any set place.

For example, we have noted that the red flowered species start in California with *Echinocereus mojavenensis* and this species gradually merges into *E. coccineus* in northern Arizona and then gradually into *E. octacanthus* of Utah and *E. neomexicanus* of New Mexico.

Further south, *E. mojavenensis* merges into *E. conoideus* and *E. polyacanthus* until all of them finally merge into *E. triglochidiatus*. At the White Sands National Monument in New Mexico and the surrounding country this latter species is a much larger form with ribbed spines and is called *E. gonacanthus*.

My own investigations have convinced me that the similarity of the flowers is so pro-

nounced and it is so impossible to identify definitely any of the body forms that it is certain that all of these species should be merged under the oldest name and the outstanding body forms be recognized as varieties, thus:

ECHINOCEREUS TRIGLOCHIDIATUS Engel.,
1848.

Echinocereus polyacanthus Engel., 1848.

Cereus Roemeri Mühlenp., 1848.

Echinopsis octacanthus Mühlenp., 1848.

Cereus Roenieri Engel., 1849.

Cereus mojavenensis Engel., 1856.

Cereus Bigelovii Engel., 1856.

Cereus gonacanthus Engel. & Big., 1856.

Cereus paucispinus Engel., 1856.

Cereus phoeniceus pacificus Engel., 1886.

Cereus phoeniceus Engel., 1856.

Cereus hexaedrus Engel. & Big., 1856.

Cereus conoideus Engel. & Big., 1856.

Echinocereus durangensis Rümpler, 1885.

Echinocereus Krausei De Smet, 1885.

Echinocereus neomexicanus Standley, 1908.

Echinocereus Rosei Wooten & Standley, 1915.

Plant globose to cylindrical, simple or clustered, ribs 5 to 14, acute to obtuse; radial spines 3 to 12, acicular to subulate; central spines wanting or from 1 to 6, acicular to subulate, terete to ribbed; flowers funnel-form, scarlet to crimson, fleshy; perianth segments broad; areoles on ovary bearing felt, hairs and spines; fruit at first spiny but later smooth, red.

Var. *gonacanthus* Engel. & Big. The few stems to 13 inches high and very robust; spines few, all ribbed.

Var. *coccineus* Engel. Stems short, almost globose, forming large mounds of 50 to 300 heads; spines acicular, grayish, sometimes long and contorted.



FIG. 67. *Echinocereus stoloniferus* Marshall. Habitat photo.

Var. *octacanthus* Muehl. Stems up to 8 or 10 inches high, usually simple or sparsely branched; spines 8-?

Var. *neomexicanus* Standley. Stems to 10 inches

high with 11 to 12 obtuse ribs; spines numerous, the centrals about 6, yellow or reddish.

Var. *paucispinus* Engel. Stems nearly globose, deep green, simple or clustered; radial spines 3 or 4, central spines wanting.

Var. *pacificus* Engel. Stems short cylindrical almost hidden by the numerous acicular spines which are reddish in color. Grows in dense clusters.

This treatment seems to offer the only possible solution since all the red-flowered plants are in one group and the few outstanding forms are recognized as varieties.

E. acifer (Otto) Lem. and *E. Leeanus* (Hooker) Lem. possibly also belong here but they have not been definitely identified in recent years.

Perhaps the greatest variation within species is found in *E. viridiflorus* and *E. chloranthus*. Both species vary from the tiny forms found in the high mountains of Colorado to the very large forms from New Mexico and Texas. The first form is usually simple while that from the south is frequently clustered. In spine coloration both species vary from a light yellow to deep red or brown and the spines may be pectinate or divergent and then frequently long and sharp. Flower colors vary from greenish yellow to a muddy brown. They should be united thus:



FIG. 68. *Echinocereus viridiflorus* Engel. x 0. 5
Photo by R. H. Lahmeyer, Fort Wayne, Indiana.

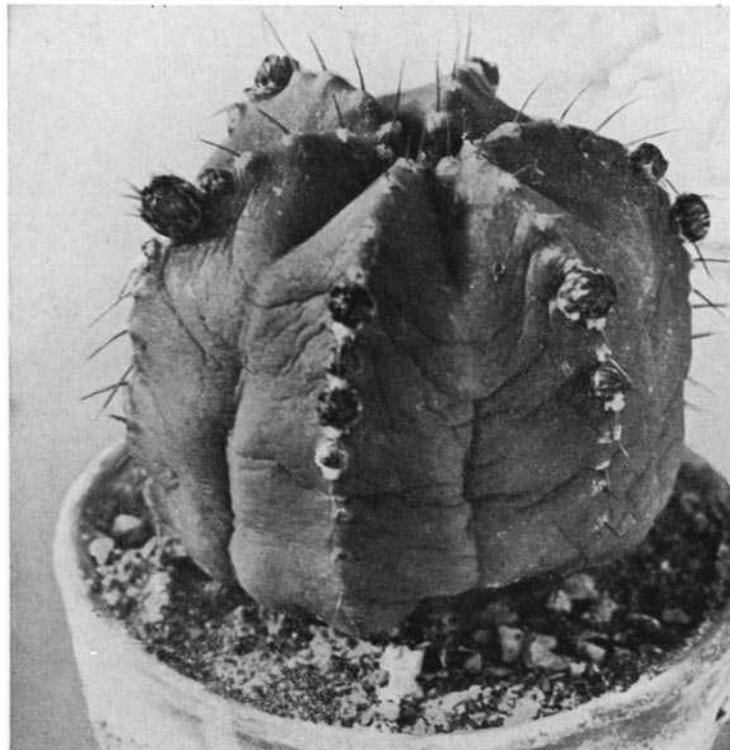


FIG. 69. *Echinocereus Knippelianus* Liebn. x 1. from Cact. & Succ. Journ. of Amer., Vol. III: pg. 116.

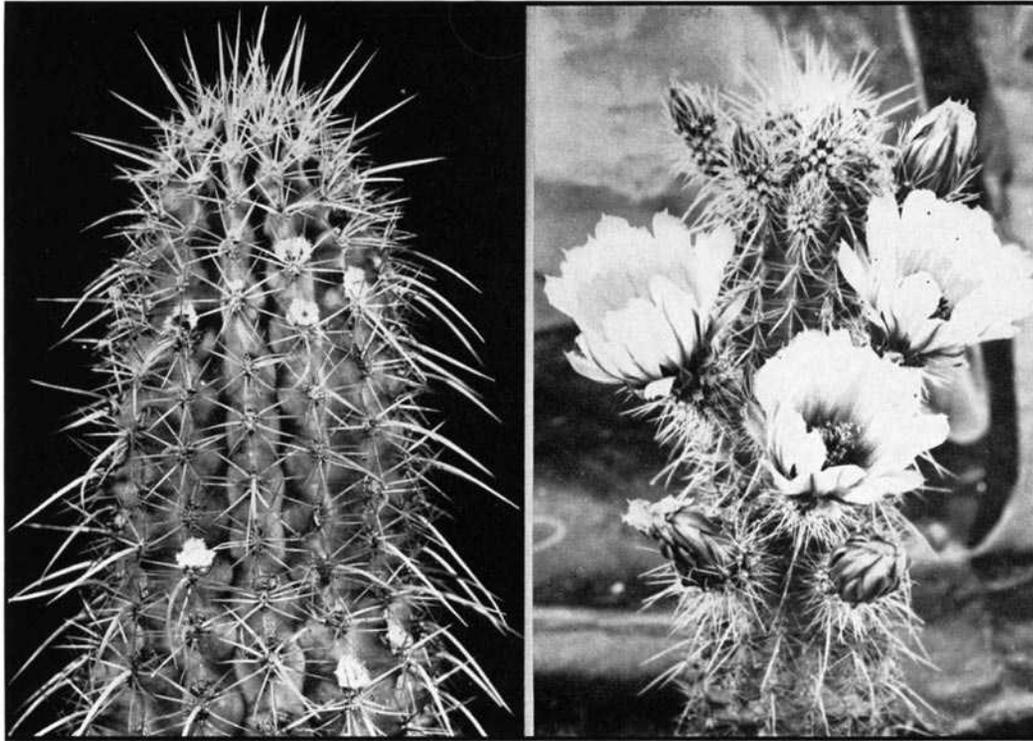


FIG. 70. LEFT: *Echinocereus Ledingii* Peebles x 0.5. FIG. 71. RIGHT: Flowers of *E. Ledingii* Peebles x 0.3 from Cact. & Succ. Journ. of Amer., Vol. VIII: pg. 35.

Echinocereus viridiflorus Engel., 1848.

Cereus chloranthus Engel., 1856.

Echinocereus chloranthus (Engel.) Rümpler, 1885.

E. viridiflorus var. *Davisii*—a dwarf form from Texas.

Other recognizable forms should be described as varieties and this will doubtless be done by the botanists now working on this group.

E. subinermis Salm-Dyck, 1856, is identical with *E. luteus* Br. & R., 1913, and the older name *E. subinermis* has precedence.

E. pulchellus (Mart.) Schum., differs in no major respect from *E. amoenus* (Dietr.) Schum., and most contemporary writers unite them under the first name, sometimes using the varietal name *amoenus* to indicate the plant with more ribs and more spines.

E. dasyacanthus Engel. intergrades with *E. rigidissimus* (Engel.) Rose, and in portions of the range are indistinguishable. In Texas, plants typical of *E. dasyacanthus* form are found with pink to purple flowers and I recently saw a plant in New Mexico of the *E. dasyacanthus* form with a purplish-pink flower from one side of the stem and a yellow flower from the opposite side. *E. ctenoides* (Engel.) Rümpler, is one of the intermediate forms of this species. For convenience the species should be written as *E. dasyacanthus* Engel. with *E. dasyacanthus* var. *rigidissimus* to indicate the purple-flowered type.

E. scopulorum Br. & R., *E. Roetteri* (Engel.) Rümpler, *E. rubescens* Dams., are very closely related to *E. dasyacanthus* and further study may result in the uniting of them.

E. pectinatus (Scheid.) Engel., *E. Reichenbachii* (Tersch.) Haage Jr., *E. Rümpleritosus* Engel., *E. perbellus* Br. & R., *E. Fitchii* Br. & R., and possibly also *E. Baileyi* Rose, are so close that they can not be definitely separated. The new species *E. oklahomensis* Lehm., *E. purpureus* Lehm., *E. albispinus* Lehm., and *E. longispinus* Lehm., are variations of the *E. Baileyi* type of *E. pectinatus* and when grown from seed cannot be distinguished one from another.

To *E. Fendleri* (Engel.) Rümpler, should be united *E. arizonicus* Rose, *E. Bonkeræ*, and *E. Boyce-Thompsonii*, as well as the white-flowered variety from northern Sonora which has been called *E. Abbea*.

E. angusticeps Clover, is a smaller form of *E. papillosus* Linke, and this may be considered as *E. papillosus* var. *angusticeps*.

Further study will unquestionably result in further consolidation of species and the setting up of a series of variations, within the several species to be indicated by trinominals for convenience in identification.

Meanwhile, we offer a classification by flower color which has no taxonomic standing and is designed solely to facilitate identification and to indicate habitat and hardness.

FLOWER COLOR GROUPING OF SPECIES OF ECHINOCEREUS

Flowers crimson to scarlet, fleshy, funnel-form

SPECIES OR VARIETY	ORIGIN	CHARACTER	RESISTANCE
1. <i>E. triglochidiatus</i>	Desert	Clustered	Medium
var. <i>gonacanthus</i>	Desert	Fleshy	Tender
var. <i>coccineus</i>	Desert	Spiny	Medium
var. <i>octacanthus</i>	Desert	8 spined	Medium
var. <i>neomexicanus</i>	Desert	Clustered	Medium
var. <i>paucispinus</i>	Desert	Soft	Tender
var. <i>Pacificus</i>	Desert	Spiny	Tender
2. <i>E. acifer</i>	Mountains	few spined	Tender
3. <i>E. Leeanus</i>	Not in cultivation		

Flowers yellow, brownish, greenish to greenish white, campanulate

SPECIES OR VARIETY	ORIGIN	CHARACTER	RESISTANCE
4. <i>E. subinermis</i>	Mountains	Few spined	Tender
5. <i>E. viridiflorus</i>	Desert	Spiny	Hardy
var. <i>Davisii</i>	Desert	Dwarfed	Medium
other varieties			Medium
6. <i>E. papillosus</i>	Desert	Few spined	Tender
var. <i>angusticeps</i>	Desert	Smaller	Tender
7. <i>E. maritimus</i>	Sea coast	Fleshy	Tender
8. <i>E. grandis</i>	Insular	Spiny	Tender
9. <i>E. stoloniferous</i>	Mountains	Spiny	Hardy
10. <i>E. Ochoterrenae</i>	Tropics		Tender
11. <i>E. dasyacanthus</i>	Desert	Spiny	Medium
12. <i>E. albiflorus</i>	Desert	Spiny	Tender

Flowers pinkish to purple, funnel-form

SPECIES OR VARIETY	ORIGIN	CHARACTER	RESISTANCE
13. <i>E. Scheeri</i>	Desert	Few spined	Tender
14. <i>E. Salm-Dyckianus</i>	Desert	Few spined	Tender
15. <i>E. huitcholensis</i>	Not known		

Flowers pinkish to purple, campanulate

SPECIES OR VARIETY	ORIGIN	CHARACTER	RESISTANCE
16. <i>E. Delaetii</i>	Desert	Hairy	Medium
17. <i>E. pensilis</i>	Tropics	Few spined	Tender
18. <i>E. Blanckii</i>	Desert	Few spined	Tender
19. <i>E. pentalophus</i>	Desert	Few spined	Tender
20. <i>E. sciurus</i>	Tropics	Spiny	Tender
21. <i>E. Standleyi</i>	Not well known		
22. <i>E. dasyacanthus</i> var. <i>rigidissimus</i>	Desert	spiny	Hardy
23. <i>E. Weinbergii</i>	Not known to me		Spiny
24. <i>E. pectinatus</i> and varieties	Desert		Hardy to Medium
25. <i>E. chlorophthalmus</i>	Mountains	Spiny	Tender
26. <i>E. Knippelianus</i>	Mexico	Fleshy	Tender
27. <i>E. pulchellus</i>	Desert	Few spined	Tender
28. <i>E. Palmeri</i>	Not well known		
29. <i>E. Brandegeei</i>	Desert	Spiny	Tender
30. <i>E. Hempelii</i>	Not well known		
31. <i>E. Merkeri</i>	Desert	Few spined	Tender
32. <i>E. Fendleri</i>	Desert	Variable	Medium
33. <i>E. enneacanthus</i>	Desert	Spiny	Tender
34. <i>E. Lloydii</i>	Not well known		Tender
35. <i>E. sarissophorus</i>	Mexico	Spiny	
36. <i>E. dubius</i>	Desert	Few spined	Tender
37. <i>E. conglomeratus</i>	Desert	Few spined	Medium
38. <i>E. stramineus</i>	Desert	Spiny	Medium

SPECIES OR VARIETY	ORIGIN	CHARACTER	RESISTANCE
39. <i>E. Barthelowanus</i>	Insular	Spiny	Tender
40. <i>E. mamillatus</i>	Desert	Spiny	Tender
41. <i>E. Engelmannii</i>	Desert	Spiny	Medium
42. <i>E. longisetus</i>	Not well known		Tender
43. <i>E. Bristolii</i>	Mesas	Spiny	
44. <i>E. chisoensis</i>	Mountains	Spiny	Medium
45. <i>E. Ledingii</i>	Desert	Spiny	Medium
46. <i>E. Viereckii</i>	Not well known		

Habitat: United States and Mexico only.

Culture: The plants of this genus are of very divergent habits and while the majority are desert plants and grow in full sunlight, some species grow in brush or on shaded hillsides. They range from the seacoast to 10,000 feet altitudes and some species are under snow all winter. Therefore, first determine the locality from which your plants come, and be guided accordingly; in the list of species we have indicated this to some extent. Generally *Echinocereus* requires a soil of one-half sand, one-fourth top soil, and one-fourth leaf-mold and the addition of some gypsum is advisable. Water sparingly except in very warm weather. They are easily flowered from cuttings and easily grown from seed.

Desirability: The attractive flowers of most species, combined with the extremely spiny stems and their availability make this a desirable species for specialization and pot culture.

RECENT NEW SPECIES SINCE BR. & R.

Echinocereus albiflorus Weing., Chihuahua, Mexico. Erect, cylindrical, branching from the base, less than 2 inches in diameter and over 2 inches long; ribs 10, tuberculate, sinuate, acute; areoles large, naked; radial spines 6 to 19, strong, flatly spreading, sometimes the lowest radial spine is more central and longer; spines grayish below, chestnut above and with swollen base; ovary and flower tube with many ivory colored spines; outer perianth segments chestnut colored; inner perianth segments brownish-white; filaments green; anthers yellow; style white; stigma lobes green.

E. Bristolii Marshall, 1938, Soypa, Sonora. Simple or branched from the base or budding half way up the stem, cylindric, light-green; ribs 15 to 16, tuberculate; areoles elongated, woolly when young, later naked; radial spines about 20, acicular, white, spreading; central spines 3, the lower one deflexed, white at base with red tips; perianth segments violet-pink, lanceolate, entire; fruit globose, red, spiny.

E. canyonensis Clover & Totter, 1941, Grand Canyon, Arizona. Cespitose; stems to 8 inches tall, blue-green; ribs 13, obtuse; areoles circular, with tawny wool in youth; radial spines 10 to 12, acicular, somewhat pectinate, somewhat flattened, yellowish with

darker tips when young, becoming dirty white to purplish in age, up to 1 inch long; central spines usually 4, darker and stronger than radials, bulbose at base, angled below and flattened toward the tip, lower one deflexed, 1 to nearly 2 inches long; flowers 2 inches long and nearly as broad, scarlet.

E. chisoensis Marshall, 1940, Chisos Mountains of Texas. Simple, cylindrical, blue-green, texture flabby; ribs, tuberculate, the confluent, dorsally flattened tubercles forming the spiralled ribs; areoles circular, densely white woolly in youth; radial spines 11 to 14, acicular, white with dark tips, later all white; central spines 1 to 4, usually 2, black, the upper one ascending, the lower one porrect, some centrals nearly 3 inches long; flowers rose colored, perianths oblong, apiculate, entire.

E. decumbens Clover & Jotter 1941, Marble Canyon, Arizona. Decumbent, yellowish green; ribs 10, prominent; areoles circular, with tawny wool when young; radial spines 11 to 12, 5 to 10 mm. long, acicular, white with red-brown tips; central spines 2 to 3, upper 2 ascending, flexible, slightly flattened, red-brown becoming rose to white; flowers not described.



FIG. 72. *Echinocereus Delaetii* Gürke x 0,33 from Cact. & Succ. Journ. of Amer., Vol. IV: pg. 289.

E. Ledingii Peebles, 1936, Mt. Graham, Pinaleno Mountains, Arizona. Densely cespitose, stems to 20 inches high; ribs 13 to 16, yellowish-green; radial spines 10 to 12, straight, spreading; central spine usually 1, about one inch long, decurved; all spines terete, translucent straw color; flowers light to dark rose-purple; fruit pale green; seeds dull black, pitted and striate.

E. Ochoterena Ortega, Southern Sinaloa, Mexico. Cespitose, cylindrical, green to purplish-green; ribs 10 to 11, prominent and slightly notched; areoles at first with white felt, later brown; radial spines 8 to 9, reddish-yellow to brown, short, spreading, centrals 4, short, darker than radials; flower nearly 3 inches long, clear canary-yellow.

E. Ochoterena var. B, has but one central spine which is longer.

E. Viereckii Werd., Tamaulipas, Mexico, 1934. Stems semi-prostrate, to 10 inches long, yellowish-green, freely branching; ribs 7 to 8; areoles small, round, with white felt which later becomes brown; radial spines 8 to 10, bristly, white, spreading, the

uppermost one very short and brown; central spines 3 to 4, acicular, cruciform, base swollen, yellow becoming gray; flowers large, pink.

A species of *Echinocereus* has been collected by H. E. Gates on an island in the Gulf of Lower California, which has white stigma lobes. It is found in collections under the name of *E. ferrariae* but has never been published.

E. stoloniferus Marshall, 1938, Guirocoba Rancho, near Alamos, Sonora. Plant simple; in colonies, connected by stoloniferous roots just below the ground, the clumps to 12 inches in diameter; individual stems gray-green, the intercostal space showing clearly through the spines, 7 inches high by 2 inches in diameter; ribs 14 to 16, indefinitely tubercled; areoles oval, with brownish wool when young; radial spines 10 to 12, setose, all lateral, spreading, black or red with white base becoming white with chestnut tips in age; central spines 3 to 5, one of which is distinctly central, deflexed, from lower part of areole, 2 to 4 others sub-central, from upper part of areole and hardly distinguishable from radials; flowers from side of stems, yellow.

Genus 2. *Acanthocalycium* Backeberg 1935.

Globose to cylindrical plants resembling *Echinopsis* or *Lobivia*. Areoles on ribs; ribs sometimes straight or sometimes spiralled, occasionally broken into notched tubercles; flowers (Pl. 11: Fig. 2), funnel-shaped, yellow to rose; tube and ovary bearing rigid scales which are papery and have woolly hairs in their axils; ring of wool inside the tube above the ovary; fruit with scales bearing woolly hairs.

Certain species formerly assigned to *Echinopsis* and *Lobivia* were found to have the common characteristic of a ring of wool inside the flower tube just above the ovary. Britton and Rose mention this characteristic on page 179 of Vol. III of "The Cactaceae" when writing of *Echinocactus spiniflorus* Schumann which they compare with "the two anomalous species which we have referred to *Lobivia*, viz., *L. thionanthus*, and *L. chionanthus*."

Backeberg, in 1935, erected the genus *Acanthocalycium* for these species and for the golden yellow-flowered *Echinocactus formosus* Pfeiffer and referred to it five other species new since the publication of "The Cactaceae."

Habitat: Argentina.

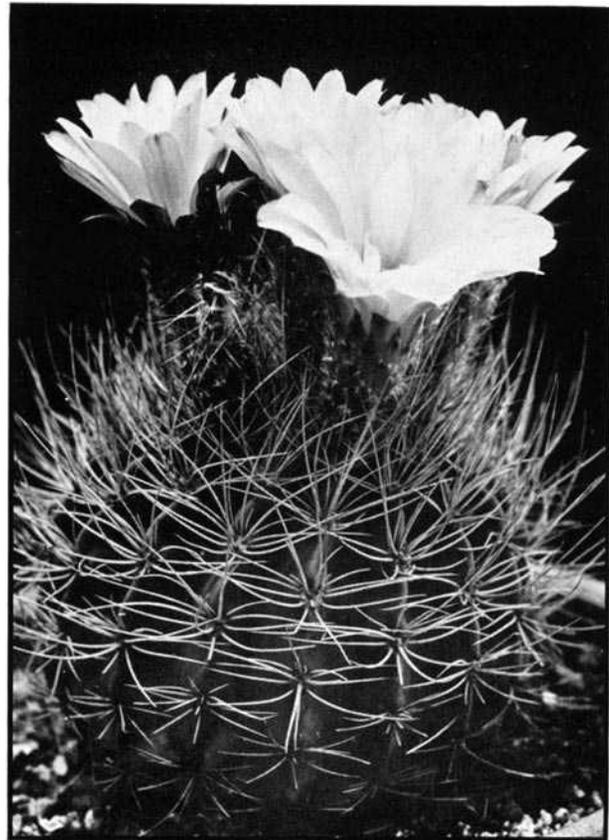


FIG. 73. *Acanthocalycium violaceum* in flower and fruit x 0.75.

Culture: A well-drained but rich soil with liberal water in growing season. If in outdoor location, as is possible in the districts of moderate temperatures, a partly shaded spot should be selected.

Desirable species: *Acanthocalycium formosum* (Pfeiff.) Bckbg. has not flowered in cultivation in the United States, but is treasured for its attractive form. *A. chionanthum* (Speg.) and *A. thionanthum* (Speg.) are obtainable and desirable. *A. spiniflorum* (Schum.) and other species are free bloomers and all species are equally attractive.

RECENT NEW SPECIES SINCE BR. & R.

A. hyalacanthum (Speg.) Bckbg. (*Lobivia* Speg. 1925, *Echinopsis* Werd.). Cylindrical with 12 to 16 ribs; the 11 to 16 radial spines and the 1 to 4 central spines reddish or white, later transparent; the flowers

are from the side of the plant, 4 to 5 inches long, golden yellow.

A. Klimpelianum (Weidl. & Werd.) Bckbg. (*Echinopsis* Weidl. and Werd. 1928, *Lobivia* Berger). Globose with a depressed top; about 19 notched ribs, not spiralled; the 6 to 10 radial and 2 central spines straight, somewhat awl-shaped, brown or black; the white flowers are only about 2 inches long, from the side of the plant.

A. oreopepon (Speg.) Bckbg. (*Lobivia* Speg. 1925, *Echinopsis* Werd.). Globose with 18 or 20 notched ribs; the 10 to 15 radial spines and the 1 to 5 central spines are all alike, slender and flexible, red to yellow, later gray; flowers from near the top of the plant, golden yellow.

A. Peitscherianum Bckbg. Globose with 17 ribs; 7 to 9 radial and 1 central spine; the small lavender flowers only about 2½ inches long.

A. violaceum (Werd.) Bckbg. (*Echinopsis* Werd. 1931). Closely resembling *A. spiniflorum* and considered by Dr. Hosseus as synonymous with that species.

Genus 3. *Rebutia* Schumann, 1895.

Syn.: *Mediolobivia* (in part) Bckbg., 1935.

Syn.: *Aylostera* Speg.

Small globose to short cylindrical plants (Pl. 11: Fig. 3), usually forming groups of several to many heads, definite ribs are lacking; the areoles surmounting small tubercles; flowers arising from the base or side of the plant are small, red,

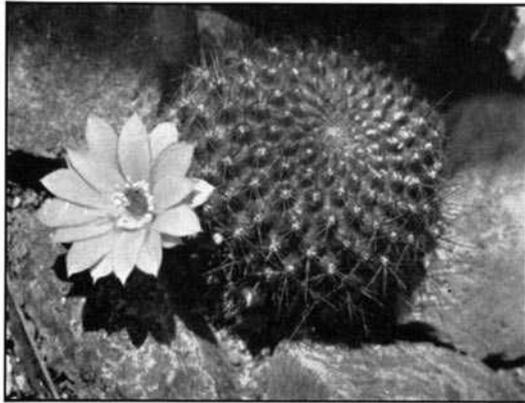


FIG. 74. *Rebutia violaciflora* Bckbg. x 1. Photo by R. H. Lahmeyer, Fort Wayne, Indiana.

orange or yellow and are funnel-shaped; in some species the pistil is enlarged to completely fill the tube but in others it is smaller; ovary bearing small scales which are without content in some species but bear hairs in their axils in other species; fruit small, red, bearing scales which some-

times subtend hairs. The genus intergrades with *Lobivia* and the dividing point is arbitrary. Efforts by some classifiers to define a definite point of departure has resulted in the erection of new genera which still leaves the matter uncertain. Here we refer the newly proposed genera *Mediolobivia* and *Aylostera*.

The plants with pistil enlarged were assigned to *Aylostera* with the notation, "pistil united to tube" but this is not true, the pistil being entirely separate from the tube but so enlarged as to completely fill it.

Habitat: Argentina and Bolivia.

Culture: Rebutias are most frequently seen as grafted plants with little or no reason, as they do well on their own roots in a light, fairly rich soil in a partly shaded location, or potted and the pots plunged in sand outdoors in the growing season and taken in for the colder periods.

Desirability: The highly colored flowers very freely produced, and the minimum of space required, makes the genus a very acceptable one.

Desirable species: Numerous species in seedling form are offered. *Rebutia Marsoneri* Werd., *R. minuscula* Schum., *R. elegans* Bckbg., and *R. violaciflora* Bckbg., are recommended, but any species is desirable.

Britton and Rose knew only five species of Rebutias: *R. minuscula*, *R. Fiebrigii*, *R. pseudo-minuscula*, *R. pygmaea*, and *R. Steinmannii* and they listed *Echinopsis deminuta* Weber, as a possible species of this genus which we now accept as *Rebutia deminuta* (Gürke) Bckbg. Intensive exploration of the cactus districts of Argentina and Bolivia have resulted in the discovery of the following new species.



FIG. 75. *Rebutia Kupperiana* Boed. x 1. Photo by R. H. Lahmeyer, Fort Wayne, Indiana.

RECENT NEW SPECIES SINCE BR. & R.

Rebutia aureiflora Bckbg., (*Mediolobivia* Bckbg.), 1934. Clustered, dark green, tinged with red; ribs formed of rounded tubercles; radial spines 15 to 20, white to brownish-white and 3 or 4 of them more central; flowers golden yellow with a white throat.

Var. *longiseta* Bckbg., (*Mediolobivia longiseta* Bckbg.). Long, numerous, golden brown bristles; flower orange.

Var. *albi-longiseta* Bckbg., with long, pure white bristles.

Var. *albisetia* Bckbg., with shorter, weak, white bristles.

R. Boedekeriana Bckbg., (*Mediolobivia* Bckbg.), 1934. Clustered, bluish gray-green, becoming yellow-green; ribs about 14, somewhat tuberculate; radial bristles 11 to 12, white, short; one central spine, shorter than the radials; flower about 2 inches wide, pale orange with a white throat.

R. chrysacantha Bckbg., 1935. Clustered, tubercled; 25 to 30 golden spines; flowers about 2 inches wide, golden-orange.

R. dasyphrissa Werd., is a variety of *R. senilis* with smaller flowers.

R. deminuta (Gürke) Bckbg., has been described as *Aylosteria* by Backeberg.

R. Duursmaiana Bckbg., (*Mediolobivia* Bckbg.) Clustered, dark green with a reddish tinge; tubercles arranged in a spiral; areoles with yellowish-white wool; about 10 bristly, white radial spines and 1 bristly central spine slightly projecting and tinged with yellow; flowers orange-yellow with a white throat; fruit red-brown.

R. Einsteinii is in cultivation but I can find no record as to its source.

R. elegans Bckbg., (*Mediolobivia* Bckbg.) is a clustered, pale green plant; tubercles small, approximate, in spiralled arrangement; areoles with a little yellowish-white wool; about 14 very short, bristly radial spines of a yellowish-white color; central spines 3 or 4 slightly longer and darker; flowers from sides and top of plant, slender, funnel-shaped, bright yellow; fruit reddish with scales and bristles.

R. grandiflora Bckbg., 1935. Similar to *R. minuscula* but with a larger flower. It should therefore be considered a variety of *R. minuscula* only.

R. Haagei Fric and Schelle. Clustered, dull green to reddish-brown; tubercles in 10 spiralled rows with minute areoles with white or brown felt; spines 4 to 12, all radial, spreading, stiff bristle-like, straight, short; flowers from the side of the stem, bright pink.

R. Knuthiana Bckbg., 1935. Clustered, tubercled; about 30 golden-brown spines and a 2-inch wide, carmine flower. This species is near to the handsome *R. Kupperiana* and perhaps a variety of it.

R. Kupperiana Boed., 1932, Bolivia. Clustered, reddish green; radial spines 12 to 16, white base with copper-colored tips; one central spine similar to radials but somewhat stronger and longer; flowers red.

R. Marsoneri Werd. Simple, depressed-globose; tubercles small; areoles small with short felt; spines bristly, 30 to 35, the lower ones white, the upper ones brownish-red; flowers from sides of plant, yellow.

R. oculata Werd. Clustered, green; ribs 10 to 14, continuous but tubercled; areoles oblong, at first woolly; spines 6 to 8, bristly, spreading, straight or curved, white or yellow with a swollen, rust-colored base; flowers from base of plant, rust-red or violet-carmine with a yellow throat.

R. pseudodeminuta Bckbg., 1934. Clustered, fresh green, tubercled; radial spines 11, of which 1 is erect and minute and others small, glassy-white; central spines 2 to 3, thin, glassy-white, all spines more or less brown tipped; flowers golden, over 1 inch in width; fruit small.

R. rubelliflora Bckbg., 1935, (*Mediolobivia rubelliflora* Bckbg.), Argentina. Cespitose, globose, green; ribs 10 to 14, spiralled, divided into tubercles; radial spines about 10, bristly, whitish, short; 1 central spine, more rigid and longer; flower funnel-shaped, reddish-orange.

R. rubrispina Bckbg., is described as having long, reddish-brown spines and a red flower.

R. rubriflora Bckbg., 1935, (*Mediolobivia rubriflora* Bckbg.), Argentina. Globose, tuberculate; spines bristly, brownish; flower flame-colored.

R. sarothroides Werd. Globose to short cylindrical, about 3 inches high and 2 inches wide; radial spines white, bristly; central spines black; flowers red.

R. Schmiedcheana (Köhler), 1939. Cespitose, cylindrical; ribs 13 to 16, tuberculate, spiralled; areoles approximate, oblong, with wool; spines 12, flexible, pectinate, appressed, somewhat curved; white and brown; flower about 1 inch long, yellow.

R. senilis Bckbg., 1932. Cespitose, the individual stems compressed globose, the apex hidden by the white spines; tubercles spirally arranged; areoles with sparse white wool; 35 to 40, glassy white bristles one inch or longer; flowers bright carmine; fruit orange.

Var. *aurescens* Bckbg. Bristles at apex of plant yellowish.

Var. *dasyphrissa* Werd. Flowers smaller.

Var. *Stuemeriana* Bckbg. (*Rebutia Stuemeriana* Bckbg.). Flowers larger than in the type, orange colored with a yellow throat.

Var. *lilacino-rosea* Bckbg. Flowers lilac-pink.

R. spinosissima Bckbg., 1935, (*Aylosteria spinosissima* Bckbg.). Clustered, stems pale green, globose, tubercled; areoles with white hairs; numerous radial and central spines which are bristly, whitish, the 5 or 6 stronger central spines horn-colored with brown tips; flowers pale brick red; fruit very small.

R. Spegazziniana Bckbg., 1934, (*Aylosteria Spegaz-*

ziniana Bckbg.). Clustered, the individual stems cylindrical, yellowish green; roots thickened; tubercles in a spiral arrangement; radial spines about 14, short, yellowish; central spines usually 2, short, yellowish with brown tips; flowers dark red with incurved petals.

R. Steinbachii Werd., has been described.

R. violaciiflora Bckbg., 1935. Solitary, dark yellowish green, globose and less than an inch in diameter; about 20. dark golden spines, the centrals darker; flowers shining rosy violet.

R. Waltheriana Bckbg., is described as having a crimson flower.

R. Xanthocarpa Bckbg., 1935. Pale-green, the individual stems to 2 inches in diameter; the very short spines are very fine, white, glassy; flowers small, bell-shaped, red with yellow ovary. Related to *R. senilis* but distinguished by the much shorter spines and smaller flowers.

Var. *citricarpa* Bckbg., (*Rebutia citricarpa* Fric), differs from the type in having a greenish ovary. If this is the only difference, then the species should be *R. citricarpa* because of earlier publication, and *xanthocarpa* should be the variety.

Var. *coerulescens* Bckbg., (said by Backeberg to be *R. dasyphrissa* Werd.), differs from the type only in the bluish red flowers.

Var. *salmonea* Bckbg., (*Rebutia salmonea* Fric). Pale red flowers and ovary.

Genus 4. *Chamaecereus* Br. & R., 1922.

A genus of one species from Argentina. *Chamaecereus Silvestrii* (Speg.) Br. & R., is a small plant of many stems, each cylinder-shaped about the size of a peanut (Pl. 11: Fig. 4) from which the common name Peanut Cactus is derived. The joints are easily detached and send out roots whenever they contact the soil. The mid-summer, scarlet flowers are small, erect, and the tube bears small scales with hair in the axils. The nearly dry fruit bears long woolly hairs.

Several hybrids of *Chamaecereus*, especially those crossed with *Lobivia*, are on the market under various names including *Pragochamaecereus crassicaulis*.

Culture: It is quite hardy and attains its best growth out of doors in milder climates, but does fairly well in greenhouse cultivation. It is frequently grafted on *Pereskias* or other stock and responds well to this treatment.

Habitat: Argentina.



FIG. 76. *Chamaecereus Silvestrii* (Speg.) Br. & R. x 1.
Photo by R. H. Lahmeyer, Fort Wayne, Indiana.

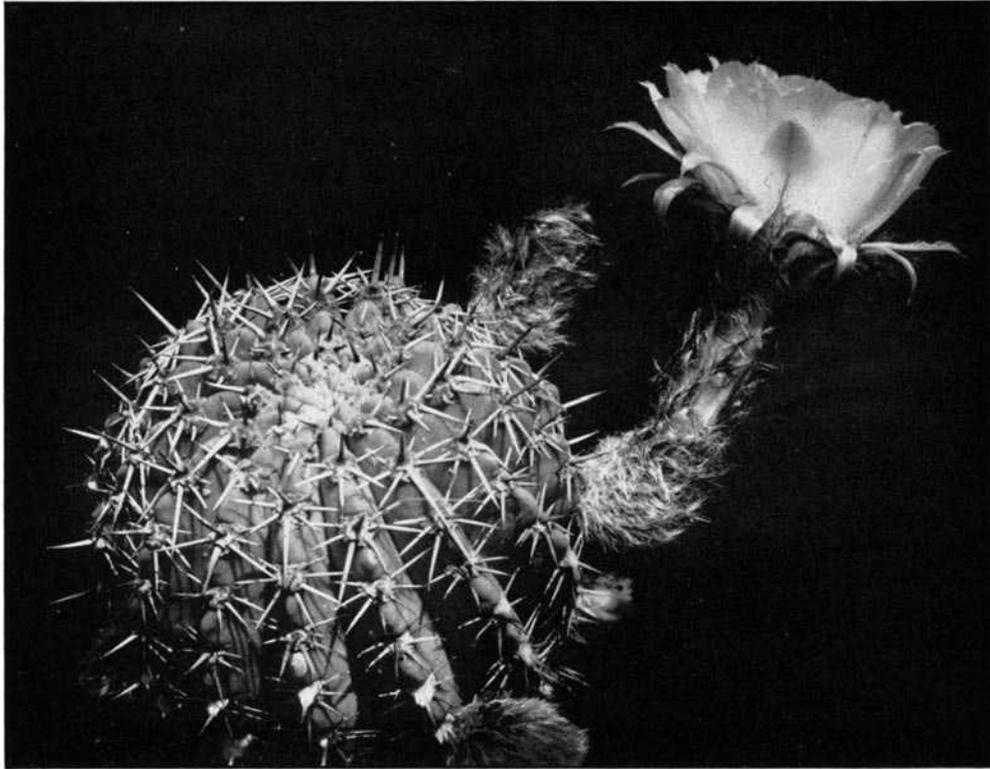


FIG. 77. *Lobivia aurea* (Br. & R.) Bckbg. Photo by George Olin, Los Angeles.

Genus 5. *Lobivia* Br. & R., 1922.

Syn.: *Echinopsis* Zucc., 1837.

Syn.: *Mediolobivia* (in part) Bckbg., 1935.

The generic name is an anagram of Bolivia from which the type plant *Lobivia Pentlandii* came. The genus is characterized by the globe-shaped or short cylindric, relatively low stems which may be simple or clustered. The stems are always ribbed and usually very spiny. The flowers bloom by day and are short funnel-shaped, or bell-shaped from the side of the stems or near the top, thereby differing from the nocturnal flowers of *Echinopsis* which they otherwise resemble. The flower tube is short and broad, and the ovary bears scales with long hairs in their axils. The fruit is small, globe-shaped. *Lobivias* are usually larger plants than *Rebutias* but this is not a positive rule and the separation of the two genera is an arbitrary one rather than a natural separation.

Habitat: Principally Bolivia.

Culture: Seedlings do well when grafted on sturdy stock and also on their own roots if given a loose but rich soil and plentiful water in warm weather. Well adapted to pot culture.

Desirability: The small size of the plants permits a large variety in a small space and the comparatively large, brightly colored flowers are very freely produced, making this a most desirable genus.

Desirable species: While almost all species offered as seedlings are interesting and worth while, the following species have proved good: *Lobivia Backebergii* (Werd.) Bckbg., *L. Herttrichiana* Bckbg., and *L. aurea*, Br. & R., formerly *Echinopsis aurea*.

RECENT NEW SPECIES SINCE BR. & R.

Of the 20 species assigned to this genus by Britton and Rose in "The Cactaceae," Vol. III, pg. 49, only the following are now retained: *Lobivia ferox*, *L. boliviensis*, *L. Shaferi*, *L. cachensis*, *L. Rümpleritosa*, *L. saltensis*, *L. cinnabarina*, *L. Pentlandii*, *L. lateritia*, *L. pampana*, *L. corbula*, *L. andalgalensis*, *L. haematantha*, *L. grandiflora*, *L. grandis* and the *L. famatimensis* mentioned in the Appendix to Vol. IV.

Their species *L. thionanthus* and *L. chionanthus* we have referred to the genus *Acanthocalycium*. Their *L. Bruchii* is referred to the genus *Eriosyce* and *L. Cumingii* is referred to the genus *Weingartia*.

On the other hand, their *Echinopsis aurea* is transferred here as is *Trichocereus huascha*. In addition, many recently discovered species of this genus have been described and these may be listed as follows:

L. Allegraiana Bckbg., 1935. Globose, about 3 inches high and broad; ribs spiralled, about 12; spines about 12 up to an inch in length, golden; flowers pale pink.

L. argentea Bckbg., 1935, Bolivia. Flattened globose, silvery gray green; ribs 24, tubercled; areoles far apart, radial spines 10 to 14, nearly one inch long; central spines 2, up to 3 inches long, dark with red base, becoming rosy-gray; flowers light lilac.

L. atrovirens Bckbg., 1935, Salta, Argentina. Cylindrical, dark green; ribs about 15; radial spines 9 to 12, very short, brown; flower not described.

L. Backebergii (Werd.), Bckbg., (*Echinopsis* Werd.). Solitary or clustered, bright green, stems to 4 inches high with broad, rounded ribs, spiralled and weakly tubercled; areoles slightly felted; radial spines 3 to 7, interlacing, spreading, yellowish-white; central spines not well defined but 2 or 3 spines over an inch long, straw yellow, twisted and sometimes hooked; flowers medium sized, bright carmine.

L. Binghamiana Bckbg., 1935, Peru. Cespitose, the stems globose, over 3 inches high and broad; ribs about 22; areoles with yellow felt; spines about 12, yellow; central, spines about 3, about ½ inch long; flowers 2 inches broad, red; fruit green.

L. breviflora Bckb.2., 1935, Argentina. Depressed globose, dark gray green, about 22 to 25 ribs with deep grooves between the areoles; areoles elongated, with white felt; spines pectinate, curved, brown becoming gray, 25 or less; radial and central spines indistinguishable, all short; flowers short, fiery red.

L. carminantha Bckbg., 1935, Bolivia. Cespitose, stems cylindrical; ribs 18; areoles distant, with felt; spines 8, the radials over an inch long and the centrals nearly 2 inches long, all reddish; flowers carmine.

L. Chereauiniana (Schlumberger) Bckbg., is a variation of *L. cinnabarina* and was so mentioned in "The Cactaceae."

L. Claeysiana Bckbg., 1937, Bolivia. Simple, dull gray green; ribs 16, narrow and thickened around the areoles; areoles at first round, later elongated and bearing yellowish-white felt; radial spines 7, radiating, horn-colored with darker tips and sometimes reddish bases, nearly an inch long; central spine 1, curved upward, 2 inches long, sometimes bent at tip; flowers 2 inches wide, pale yellow.

L. cylindrica Bckbg., 1935. Cylindrical to 5 inches high and more than 2 inches in diameter; about 11 ribs; areoles approximate and containing gray felt; about 7 subulate radial spines, short, rosy; central spine 1, to an inch in length; flower golden; fruit green.

L. densispina Werd., 1934. Sometimes considered as a variety of *L. famatimensis*. Simple, ovoid, apex densely woolly; ribs about 17, continuous, with transverse sulcations between areoles; radial spines 16 to 22, acicular, flexible, silvery, flatly spreading; central spines 4 to 7, dark brown with black tips, erect or incurved; flowers yellow.

L. digitiformis Bckbg., 1935, Argentina. Long, finger-shaped, 3 inches high and less than an inch in diameter, grayish-green; ribs 12, low, divided into tubercles, these bearing sparse yellow brown or white wool; radial spines about 12, short, yellowish-white with brown base later grayish; central spine one, brown, short; flower red.



FIG. 78. *Lobivia Backebergii* (Werd.) Bckbg., x 0.5. Photo by R. H. Lahmeyer, Fort Wayne, Indiana.

L. Drijveriana Bckbg., 1933, Argentina. Solitary, cylindrical; rootstocks turnip-shaped, stems gray green; radial spines 10 to 12, flatly spreading, whitish; central spines wanting in young plants, later 1 to 4, sometimes curved, pale yellow to black; flowers rotate, pale yellow; pistil green.

Var. *aurantiaca* Bckbg. Flowers orange; pistil purple.

Var. *nobilis* Bckbg. Flowers dark red-orange; pistil pale purple.

Var. *astranthema* Bckbg. Unlike the type, this variety forms clusters, has very short radials, no centrals and larger, bright yellow flowers.

L. euanthema Bckbg., 1934, Bolivia. Rootstocks carrot-like; body simple or few-stemmed of small size, dull leaf-green, 2 inches high at the most, weakly tuberculate, vertical ribs; 12 glassy white bristles, reddish at the base, from each areole; flowers carmine outside, inside yellowish-red with a red throat.

L. eucaliptana Bckbg., 1935, Bolivia. Cespitose; areoles approximate; ribs 8 to 9; radial spines 9 to 11, bristly, short; central spine wanting; flowers red.

L. famatimensis (Speg.) Br. & R., Argentina. To this well known species the following varieties are assigned:

- Var. *aurantiaca*. Golden to orange flowers.
 Var. *cinnabarina*. Carmine flowers.
 Var. *haematantha*. Blood-red flowers.
 Var. *longispina*. Central spine light brown and up to nearly an inch long.
 Var. *longiseta*. Similar to *L. densispina* Werd.
 Var. *nigricans*. Body olive green; spines black.
 Var. *oligacantha*. Radials strongly appressed, central up to nearly 3 inches.
 Var. *rosiflora*. Flower rose colored.
 Var. *setosa*. Spines bristle-like.
L. Haageana Bckbg., 1933, Bolivia and Argentina. Cespitose, the individual stems to 12 inches high, dull gray green; areoles elliptical, large, with white wool; radial spines 10, straw colored, spreading sidewise; central spines 3 to 4, black when young, up to nearly 3 inches long; flowers bell to funnel-shaped, bright yellow with a red throat.
 Var. *albihepatica* Bckbg. Flowers reddish-ochre yellow.
 Var. *chrysantha* Bckbg. Spines pure yellow; flowers golden-pink.
L. Hardeniana Boed., 1935. About 21 ribs; areoles elliptical; radial spines 10 to 12, more than an inch long; central spines 2 to 3, up to 2 inches long, all spines reddish; flower golden, tipped red.
L. hastifera Werd., 1939, Argentina. Simple, subglobose; apex not depressed and unarmed; ribs about 16 or more, not distinctly tubercled; radial spines 5 to 9, subulate, straight, gray, about 1 cm. long; central spines 4, porrect, apex curved, up to 4 inches long,

with swollen base, yellowish-gray; flowers funnelform, rose colored; style pale green; stigmas yellow green.

L. Hermanniana Bckbg., 1935, Bolivia. Cespitose, the stems cylindrical up to 8 inches high; ribs 13; areoles with wool; spines short, thin, elastic, golden brown; flowers violet-rose to cinnabar-red.

L. Hertrichiana Bckbg., 1933, Peru. Named in honor of our own Wm. Hertrich, Curator of the Huntington Botanical Gardens. Solitary in nature but cespitose in cultivation, very small, light glossy green; ribs about 11 with acute edges and deep cross grooves above the areoles; areoles round and filled with wool; radial spines about 7, spreading, brownish yellow; one central spine curved upward, straw-colored, up to 1 inch long; flowers fairly large, rotate, scarlet; fruit small, round, hairy.

L. Higginsiana Bckbg., 1934, Bolivia. Depressed spherical, gray olive green; ribs 15 to 17, divided into hatchet-shaped tubercles; radial spines about 10, curved downward, the lower ones very short, the two upper ones nearly 2 inches long; central spine 1, up to 3 inches long, curved upward; flowers outwardly rosewood color, yellowish within; fruit hairy.

L. Hossei (Werd.) Bckbg., 1931, Argentina. Solitary, cylindrical, grayish-green; radial spines 7 to 8; central spines 1 to 3, up to an inch long; flower orange, tinged reddish outside, slightly perfumed.

L. huascha (Weber) Marshall, 1893, Argentina. In the Cact. & Succ. Journ. of Amer., Vol. IX: pg. 114, the reasons for changing this diurnal, short tubed species to *Lobivia* was fully covered. Flowers yellow. This plant was called *Trichocereus huascha* by Britton and Rose.



FIG. 79. *Lobivia huascha* (Weber) Marshall x 0.2. Photo by Wm. Otte, Santa Barbara, California.

L. incaica Bckbg., 1935, Peru. Cylindric to 6 inches high and 3 inches thick; ribs about 15; areoles with yellow felt; radial spines 14 to 20, light brown to reddish, later gray, about 7 of these more central, all short; flower blood-red.

L. iridescens Bckbg., 1935, Bolivia-Argentina border. Cespitose, rootstocks carrot-like, gray green; somewhat oblique ribs formed by tubercles separated by sulcations; areoles small, white woolly; radial spines 7 to 9, whitish, somewhat curved, short; central spine 1, apex somewhat hooked, dark; flowers rose colored, iridescent.

L. jajoiana Bckbg., 1933, Salta, Argentina. Usually solitary, cylindrical, sap-green; ribs composed of hatchet-shaped tubercles; radial spines about 10; pinkish-white, up to 1 cm. long; central spine 1, thinner than the radials, blackish, nearly an inch long; flowers dark wine red with a bluish shade; fruit small, round, hairy.

Var. *Fleischeriana* Bckbg. All spines longer, 4 radial spines stiffer, the upper ones sometimes hooked; central spine up to 2 inches long, very thin, all spines brighter than in the type.

L. janseniana Bckbg., 1935, Argentina. Solitary, with long, tuberous roots, becoming 8 inches high, dull gray-green; ribs 11 to 14, vertical; areoles sunken, small, with yellowish felt; spines about 10 to 14, black, reddish below when young, about 1 cm. long, when older about 4, becoming longer and stouter; flower golden yellow with a reddish throat.

L. Johnsoniana Bckbg., 1935, Bolivia. Clustered, depressed-globose; areoles distant, bearing felt; radial spines 1 to 7, spreading flatly; central spine 1, up to an inch long or longer; flower nearly 2 inches broad.

L. Kupperiana Bckbg., 1935, Bolivia. Grayish, 4 inches high and 3 inches broad; ribs 20; areoles remote, round, bearing white felt; radial spines about 20, flatly spreading, at first brown later grayish with darker tips; central spines 3 to 4; flower unknown.

L. leucomalla Wessn., 1938, Argentina. Is unknown to me but the description agrees with that of *L. densispina* Werd., in most details and it may be a variety of that species or very close to it.

L. leucorhodon Bckbg., 1935, Bolivia. Cespitose, body tapering into a tuber-like root; leaf green; about 21 ribs, narrow tuberculate, the tubercles long and narrow; radial spines about 7, yellowish, flatly spreading; central spine 1, horn-colored, curved upward, about an inch long; flowers rotate, pale lilac with white throat.

L. leucoviolacea Bckbg., 1935, Bolivia. Gray-green with sharp ribs; areoles far apart; radial spines about 14, short, pinkish; flower 2 inches long, rosy-lilac.

L. mistiensis Bckbg., 1931, Peru. Simple or cespitose, cylindrical, blue grayish-green; areoles distant, bearing much wool; spines usually 9 to 10, irregularly arranged, gray to brown, interwoven, up to 2 inches long; flowers rosewood colored, paler within with red central stripe; fruit yellow-green.

L. Nealeana Bckbg., 1934, Argentina. Simple cylindrical, up to 3 inches high, pale leaf-green, reddish

brown below; ribs 14, low; radial spines about 8, very fine, yellow, thickened and reddish at base, short; flowers large, bright red, rotate.

L. Neohaageana Bckbg., 1933, Argentina. Cespitose, with long tuberous roots; ribs 10 or 11, divided into tubercles; body gray to bluish-green, often tinged with red on the tubercles; areoles close together, with brownish felt; spines 10 to 12, bristly, glassy white with reddish base, flatly spreading; flowers rotate, from pale to dark salmon.



FIG. 80. *Lobivia pseudocachensis* Bckbg. x 0.5. Photo by R. H. Lahmeyer, Fort Wayne, Indiana.

L. nigripina Bckbg., 1935, Argentina. Cespitose, somewhat cylindrical, less than 2 inches high, ribs 15, thin, grooved under the tubercles; radial spines about 10, acicular, short, sometimes 4 of these more central; flower unknown.

L. orurensis Bckbg., 1935, Bolivia. Cespitose, olive-green to reddish, less than an inch in diameter; ribs 9; areoles approximate and bearing brown felt; spines about 10, appressed, very short; flowers red.

L. pectinata Bckbg., 1935, Bolivia, Argentina. Near *L. neohaageana*; grayish-green, body elongated and acute; spines spreading.

L. planiceps Bckbg., 1935, Peru. Simple, flattened-globose, green; ribs about 13, nearly straight; areoles distant and bearing white felt; radial spines 10, unequal, the longest 1 inch long, somewhat curved, horn-colored later dirty gray; central spines 2 or 3, base thickened; flowers funnel-form, dark red.

L. polycephala Bckbg., 1935, Argentina. Cespitose globose, gray-green to olive green; ribs 16, areoles distant, bearing felt; radial spines 10, very short; central spines 3 to 4, longer and heavier than the radials, brownish to reddish; flower relatively large, carmine.

L. potosina Werd., Bolivia. Solitary, globular, bright green, over three inches in diameter; ribs about 13, very prominent; areoles few but large, about 2 inches apart; bearing short brown felt when young; radial spines 8 to 12; central spines 1 to 4, whitish to rust-colored, later grayish brown, very stiff, thickened at base, nearly 2 inches long, curved upwards, some hooked at tip; flower pink to crimson.

L. pseudocachensis Bckbg., 1934, Argentina. Cespitose, globose, light green; rootstock turnip-like; ribs about 12 to 14, rounded; areoles small, closely set; radial spines about 10, thin, rusty yellow, flatly spreading; central spine 1, dark brown, curved; flowers bright, dark red.

L. rhapsidacantha Bckbg., 1935, Bolivia. Cespitose, dark green; ribs acute; areoles distant; spines about 7, unequal, radials curved; central up to 3 inches long, at first dark brown with red base, later gray; flowers not mentioned.

L. rebutioides Bckbg., 1934, Argentina. Densely clustered; rootstocks tuberous; individual stems about ½ inch in diameter, dull bluish-green; ribs about 10, straight; areoles closely set, very small; spines 8 or 9, bristly, glassy-white, ovary short; flowers fiery red.

L. Ritteri Wessn., 1938, Bolivia. Globose-cylindrical, gray-green, branching from base; rootstocks carrot-shaped; ribs 15, tuberculate; areoles close together, elliptical; radial spines 8 to 10, grayish, spreading, short. no central spines; flowers funnel-shaped, red to violet-red; stamens carmine; anthers yellow; style yellowish green; stigma lobes 7, erect; fruit dark red.

L. Rossii Boed., Bolivia. Simple, globose, apex not depressed; ribs 18, with hatched-shaped tubercles; areoles round, small, sparsely woolly; spines all radial, subulate, pungent, base swollen, spreading; flowers nearly 2 inches, yellow.

L. rubescens Bckbg., 1933, Argentina. Perhaps better considered as a variety of *L. Haageana* which it resembles in its golden flower with a red throat. It has, however, about 12 radial spines and 4 central spines.

L. sanguiniflora Bckbg., 1935, Argentina. Simple, globose, dark green or paler; ribs spiralled, crenate; areoles large, oblique; radial spines about 10, unequal, dark with red base becoming gray; central spines sev-

eral, one up to 3 inches long, hooked; flowers 2 inches long, red.

L. Schreiteri Castell., 1930, (*Echinopsis* Werd) Argentina. Cespitose, the, individual stems small, dark green; ribs 9 to 14, roundish, forming square tubercles; areoles small, with white felt; radial spines 6 to 8, spreading, curved, the lower ones white, the upper ones dark brown; central spine usually wanting, but sometime 1, curved, nearly an inch long; flowers purple-red.

L. scoparia Werd., 1939. Simple or cespitose, globose; ribs about 13, continuous; areoles close together with white or dirty yellow wool; radial spines 20 to 30, unequal, white, tipped with hard edge or sharp point, acicular, incurved to straight, flexible, short; central spines 3 to 6, chestnut brown, acicular, erect, over ½ inch long; flowers over 2 inches long, orange.

L. sublimiflora Bckbg., 1935, Argentina. Cespitose with carrot-shaped roots and small stems, ovate-spherical, reddish to fresh green; ribs about 12, low, straight, somewhat tuberculate; radial spines about 10, appressed, bristly, white; central spine 1, bristly, very short; flowers over 2 inches long, pale crimson.

L. varians Bckbg., 1935, Bolivia. Cespitose, flattened globose, 4 inches in diameter and 3 inches high, gray-green; ribs 21, oblique, with angled tubercles; areoles distant, at first slightly woolly; spines about 10, unequal, some to 4 inches long, at first brown, later reddish gray; densely tangled; flowers funnel-shaped, over 2 inches long, reddish-orange.

Var. *croceantha* Bckbg., 1935. Flowers saffron-colored.

L. Wegheiana Bckbg., 1933, Bolivia. Simple, with long tap root; ribs about 20; tubercled, hatchet-shaped; areoles ½ inch apart with grayish wool; radial spines 7 to 8, dark at first, pointing right and left; central spine 1, directed upwards, to 1½ inches long; flowers lilac-colored; stigma lobes 9, green.

Genus 6. *Echinopsis* Zuccarini, 1837.

This is a genus of large-flowering, small, globe-shaped plants which, in age, occasionally become cylindrical in shape and up to twelve or fourteen inches in height or in one or more species as much as three feet high. The stems are ribbed and the ribs are usually high, producing a fluted appearance in cross section (Pl. C: Fig. 13), and the areoles on the ribs usually bear felt and spines. The long funnel-shaped, white to rose colored flowers (Pl. 11: Fig. 6), are night-blooming, and in some species, remain open until late in the day while a few remain for several days and nights. The ovary and flower tube bear scales which have long hairs in their axils.

The genus intergrades with *Trichocereus* and the division is an arbitrary one; usually the flowers of *Echinopsis* have longer and slimmer

tubes than those of *Trichocereus* but there are exceptions. Both genera produce flowers that open at night and the ovary and flower tubes of both are scaly and the scales have long hairs, usually silky, in their axils. Usually *Trichocereus* are columnar plants and *Echinopsis* are globose. However, columnar *Echinopsis* are known as are also globose *Trichocereus*. The reddish to greenish, very hairy fruits of *Echinopsis* are similar to the fruits of *Trichocereus* and in both genera the fruit expels its seed by splitting.

Habitat: Central Argentina to Central Bolivia.

Culture: A fairly heavy, rich soil is required for species of this genus, protection from full sun and ample water in growing seasons. Several species are very hardy and *Echinopsis multi-*

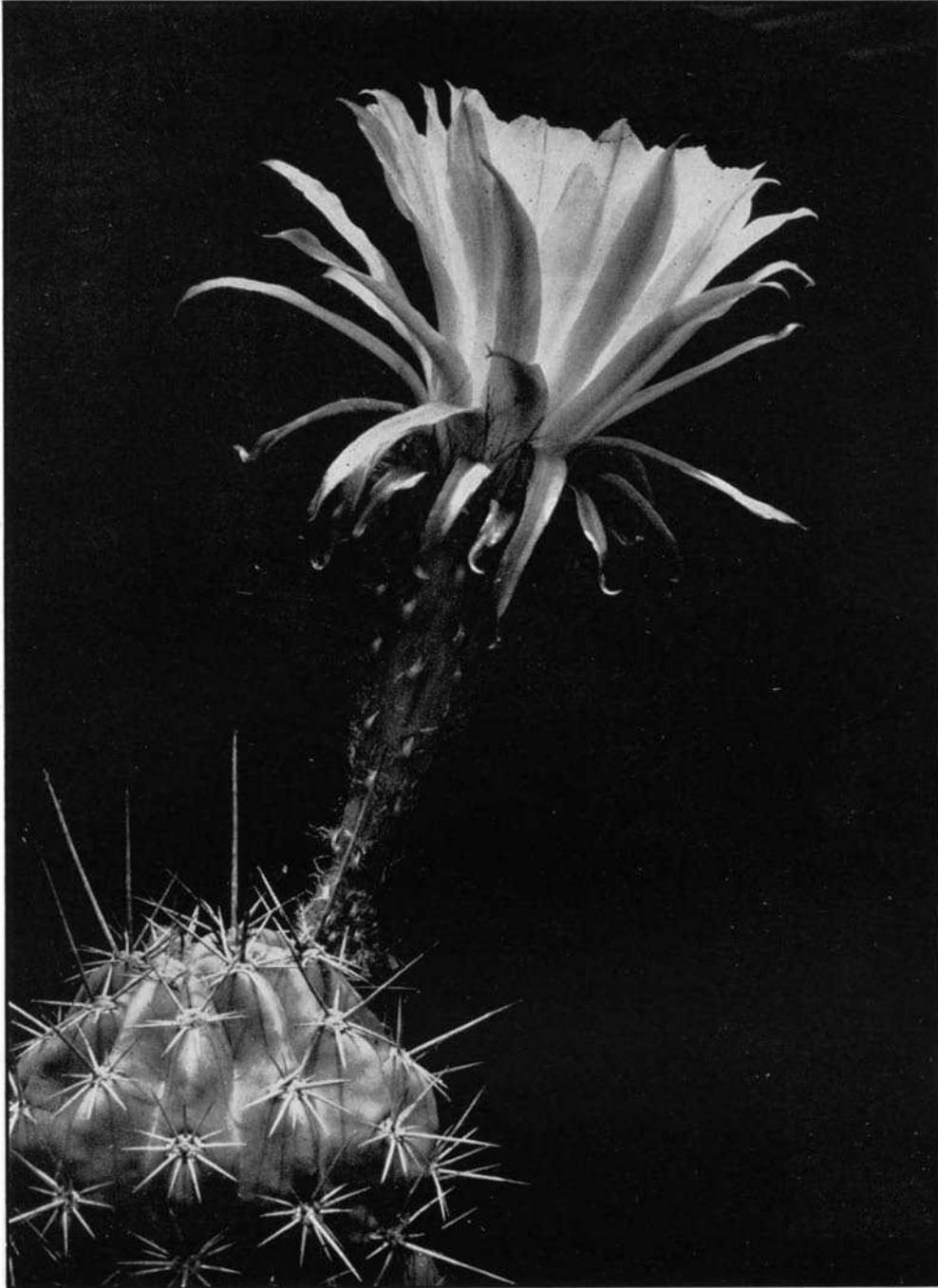


FIG. 81. *Echinopsis Bridgesii* Salm-Dyck x 0.5. Photo by George Olin, Los Angeles.

plex (Pfeiff.) Zucc., is grown outdoors in the United States and Canada in sections where plants are under snow all winter. Suggested soil mixture: $\frac{1}{2}$ garden loam, $\frac{1}{4}$ leaf-mold and $\frac{1}{4}$ sharp sand. An application of fertilizer twice a year is recommended. *Echinopsis* are easily grown from seed and propagation by cutting is greatly simplified by the fact that off sets near the

base of the plant form their own roots while still attached to the parent.

Desirability: The large, showy flowers and ease of cultivation make this one of the most widely grown genera in the Cactaceae. When planted for massed color with beds of white-flowered species alternated with beds of rose colored species, a striking effect is produced.

Desirable species: Any and all species are desirable and most species are obtainable.

RECENT NEW SPECIES SINCE BR. & R.

Britton and Rose in "The Cactaceae," Vol. III: pgs. 60 to 77, recognized 28 species from which *E. aurea* Br. & R. is transferred to *Lobivia*, *E. mirabilis* is transferred to *Arthrocerus*, and *E. formosa* (Pfeiff.), to the genus *Acanthocalycium*, but *E. Mieckleyi* Meyer "The Cactaceae," Vol. III: pg. 75, which was listed as uncertain, is now accepted as a valid species, as are *E. Ducis Paulii* Förster, *E. formosissima* Lab. "The Cactaceae," Vol. III: pg. 76.

There remain the following species of Britton and Rose:

<i>E. Meyeri</i>	<i>E. ancistrophora</i>
<i>E. Forbesii</i>	<i>E. Spegazziniana</i>
<i>E. Huottii</i>	<i>E. Shaferi</i>
<i>E. minuana</i>	<i>E. Fiebrigii</i>
<i>E. multiplex</i>	<i>E. rhodotricha</i>
<i>E. oxygona</i>	<i>E. leucantha</i>
<i>E. Eyriesii</i>	<i>E. obrepanda</i>
<i>E. turbinata</i>	<i>E. intricatissima</i>
<i>E. tubiflora</i>	<i>E. molesta</i>
<i>E. albispinosa</i>	<i>E. Baldiana</i>
<i>E. Silvestrii</i>	<i>E. Bridgesii</i>
<i>E. calochlora</i>	<i>E. mamillosa</i>
<i>E. cordobensis</i>	

Echinopsis albiflora Schum., Argentina. Globose, about 4 inches in diameter, bluish-green, later grayish-green; ribs 10 to 11, acute, notched; areoles on prominences, distant; spines all alike, about 13, straight or curved, about ½ inch long, reddish-brown becoming gray, dark tipped, the inner spines shorter; flower 8 inches long; outer petals linear, acute, bluish-green; inner petals white; stamens white; style pale green; stigma lobes 13, greenish.

E. campylacantha Pfeiff., 1839, Argentina. Referred to *E. leucantha* by Br. & R. Globular, almost columnar, dark green; ribs 12 to 14, straight; radial spines 7 to 8, yellowish or grayish, central spine 1, about 2 inches long, curved upward, thick and dark brown; flowers from the side of plant, 6 to 7 inches long, limb over 2 inches broad; tube with brown scales and brown wool; outer petals brownish-green; inner petals white with a pinkish flush slightly perfumed; stigma lobes 12 to 15, erect, green. (See *E. leucantha*.)

E. ferox Bckbg., is *Lobivia ferox* Br. & R., and was described in "The Cactaceae," Vol. III: pg. 50, but with the notation that flowers were unknown. Backeberg, in transferring it to the genus *Echinopsis*, "Kaktus ABC," pg. 220, also lacks a flower description which seems to make the shift of genera unreasonable.

E. hamatacantha Bckbg., 1934, Argentina. Flattened globose to 3 inches high and 6 inches in diameter, light green; ribs 27; areoles small; radial spines 8 to 15, appressed, short; central spine hooked; flower up to 8 inches long, white.

E. kratochviliana Bckbg., 1934, (*Echinopsis hamatispina* Werd., *Lobivia Graulichii* Fric nom. nud.), Argentina. Depressed globose, dark green to brown-

ish gray-green; ribs up to 18; areoles closely set; radial spines up to 15; central spine up to 2 inches long, hooked; flower short, white.

E. leucorhodantha Bckbg., 1934, Argentina. Globose to slightly cylindrical, dark green; ribs about 20, narrow, slightly tubercled; radial spines 9, yellow becoming gray, the 2 lowest very hair-like; central spines

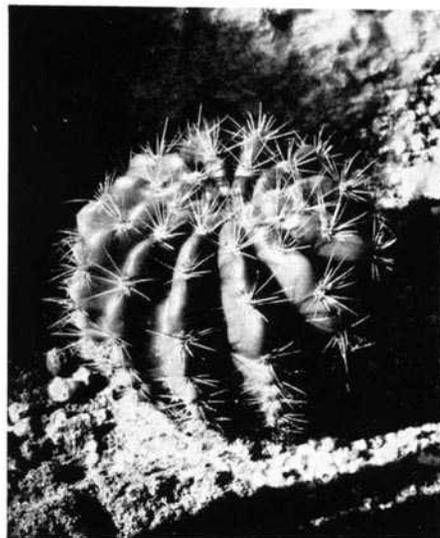


FIG. 82. *Echinopsis calochlora* Schum. x 0.5 from Cact. & Succ. Journ. of Amer., Vol. VI: pg. 166.

1 to 2, erect, the lowest of ten bent upwards, ½ inch long, yellow with a darker tip; flowers about 5 inches long, opening in early morning, pale pink and white, sweetly scented.

E. leucantha (Gilles) Walp., 1843, Argentina. The description in "The Cactaceae" seems to be a composite of this and *E. campylacantha*, therefore this description seems advisable that the two good species be recognizable: Globular becoming oval, grayish-green, about 5 inches in diameter; ribs about 14, slightly notched; areoles with whitish-yellow felt, distant; radial spines about 10, more or less twisted, yellowish brown, up to 1 inch long; central spine 1, brown, curved upwards, up to 4 inches long; flower near top of plant, 8 inches long, with narrow tubes; outer petals brownish green; inner petals white; stigma lobes 12, yellow. It has the fragrance of violets.

Var. *brasiliensis* Speg. Shorter radials and smaller flowers.

E. lobivoides Bckbg., 1934. Resembles *Lobivia cinnabarina* but with a white flower.

E. longispina Bckbg., is *Lobivia longispina* Br. & R., which Backeberg transfers here because of the white, nocturnal flower, which is up to 4 inches long and not 4 cm. (1½ inches) as noted by Br. & R.

E. Mieckleyi R. Meyer, Bolivia. Described in "The Cactaceae," Vol. III: pg. 75. This species as well as *E. formosissima* were described without flowers.

E. nigra Bckbg., 1935, Argentina. Globose to somewhat elongated, grayish-green; ribs about 20, acute, somewhat tuberculate; radial spines 12 to 14, unequal, curved; central spine distinct only when young, at first hooked, later curved and imbricate, all black; flowers to 4 inches long, white.

E. pelecyrhachis Bckbg., 1934, Argentina. Flattened globose, ribs acute; radial spines 10, very short; central spine longer; flower 4 inches long, white.

E. polyancistra Bckbg., 1935, Argentina. Small, flattened globose, green; ribs 17 to 30, rounded; somewhat tuberculate; spines numerous, bristly, flexible, one-fifth inch long; central spine curved and hooked on end, flower white, perfumed, to 4 inches long.

E. potosina Werd., 1931, Bolivia. Globose; ribs 13, high, acute; areoles distant bearing light brown felt; spines 9 to 13 of which 2 to 4 are central, subulate, nearly 2 inches long; flower white.

E. pugionacantha Rose & Boed. Simple, globose; ribs 16 to 17, straight or spiralled; areoles filled with gray wool in youth; radial spines 45, flatly spreading, yellow to white with black tips, straight, subulate, dagger-shaped, one-fifth inch long; centrals wanting; flowers unknown; fruit green, small. This species was described without flowers and was transferred to *Lobivia* by Backeberg also with the notation that the flowers had not been seen.

E. Robinsoniana Werd., 1934, (possibly *E. turbinata*). Simple, columnar to 3½ feet high or more and 6 to 8 inches in diameter, pale green, apex depressed, woolly and spiny; ribs 19; areoles elevated, close together and bearing gray wool; spines 10 to 12 straight or curved, acicular, up to 1 inch long; flowers 6 inches long or more, white; stigmas 24; stamens included.

Described from a plant in the Huntington Botanical Gardens, San Marino, California.

E. Smrziana Bckbg., 1935, Argentina. Cespitose, at first globose becoming cylindrical, bright green, later gray-green; ribs 10 to 15 rounded; spines about 14, white to yellow-brown, acicular, flexible, sharply pointed, from very short to nearly an inch long.

The following hybrids are offered in the market:

E. Decaisneana Walp., 1843. Near *E. turbinata*.

E. Eyriesii Zucc.

var. *triumphans*-rose flower.

var. *Muelleri* Hort.

var. *Quehlii* Hort.

var. *nigerrima* Hort.

var. *undulata* Hort.

var. *Duvalii* Hort.

var. *Schelhasei*. (Zucc.).

var. *Wilkensii* (*Eyriesii* X *oxygona*)

E. oxygona

var. *inermis* Jac.

E. rhodotricha

var. *argentinensis* R. Mey.

var. *robusta* R. Mey.

E. turbinata hybrids

var. *gemmata* Schum.

var. *falcata* Rümpl.

var. *tephracantha* Hort.

var. *tacuarembense* Arech.

E. tubiflora hybrids.

var. *Rohlandii* (*tubiflora* X *oxygona*)

var. *Droegeana*

var. *Poselgeri* (*tubiflora* X *leucantha*)

var. *Tettavi* (*tubiflora* X *Eyriesii*)

var. *Lagemannii*

E. valida Monv.

Sub-tribe 4. Echinocactanae

Genus 1. *Denmoza* Br. & R., 1922.

Syn.: *Echinocactus* Salm-Dyck, 1834.

Syn.: *Pilocereus* Schum., 1897.

Syn.: *Echinopsis* Salm-Dyck, 1850.

Syn.: *Cleistocactus* Lem., 1861.

Denmoza rhodacantha (Salm-Dyck) Br. & R. was recognized in "The Cactaceae" as a globose to cylindrical plant. It is strongly ribbed and spiny. The flower (Pl. 12: Fig. 1), which is similar to the flower of *Cleistocactus*, *Borzicactus*, etc., is scarlet with a slender throat and very narrow limb, and the mouth is closed with a mass of white wool. The ovary and tube bear many scales, their axils filled with silky hairs. Seedling forms are globe-shaped and have long curved spines, usually red. A desirable addition, to any collection. The generic name is an anagram of Mendoza, the province in Argentina, where the plant is native. *D. erythrocephala*



FIG. 83. *Denmoza rhodacantha* (Salm-Dyck) Br. & R. x 0.5. Note the tubular, closed flower with exserted stamens. Photo by R. W. Kelly, Temple City, California.

(Schum.) Berg., was confused by Britton, Rose, and Spegazzini with *D. rhodacantha*, but it is as distinct in old specimens as in seedlings.

To adjust confusion a short description of both species follows:

Denmoza rhodacantha (Salm-Dyck) Br. & R., Argentina. Globular, later cylindrical, sparingly cespitose, dull dark green, 4 to 6 inches thick, ribs about 15, acute, straight but more or less wavy; areoles oval, with gray wool on slight prominences, distant; radial spines 8 to 10, yellowish-red to blood red, later rusty-red and when old, gray, all equal, subulate, curved backwards

and upwards; central spine one or none, all spines up to an inch or more in length; flower nearly 3 inches long, from the top of the plant, red, closed, with protruding red stamens, red anthers, and a stigma with red lobes.

Denmoza erythrocephala (Schum.) Berg., Argentina. Simple, at first globose becoming cylindrical up to 4 feet or more; ribs 20 to 30, low, rounded; spines 30 or more, the centrals straight or curved, subulate, red when young, later rusty-red and finally gray; radial spines bristly; flexible, whitish; flowers 3 inches long, similar to the preceding species.

Genus 2. *Ariocarpus* Scheidweiler, 1838.

Syn.: *Anhalonium* Lemaire, 1839.

Syn.: *Roseocactus* Berger, 1936.

As considered by Britton and Rose, this genus had but 3 species: *Ariocarpus retusus* Scheid. (with which they united the very distinct species *A. furfuraceous* Coulter and *A. trigonus* Schum.), *A. Kotschoubeyanus*, and *A. fissuratus*.



FIG. 84. *Ariocarpus retusus* Scheid. x 0.5 at Knickerbocker Nursery, San Diego, California. Photo by Graham Heid.

Berger, in 1925, proposed that *A. fissuratus* (Pl. 12: Fig. 2), its variety *Lloydii* and *A. Kotschoubeyanus* be assigned to the genus *Roseocactus* (in honor of Dr. J. N. Rose) and Backeberg has followed in this separation, although it has been rejected by other contemporary writers.

It seems best to place in *Ariocarpus* all of the

species assigned there by Britton and Rose and the newly discovered *A. scaphorostrus* of Boedeker.

The character on which Berger based his separations is the wool-filled groove common to *A. fissuratus* and *A. Kotschoubeyanus* which so greatly puzzled the eminent Dr. Engelmann who first considered these species as Mammillarias but later assigned them to a separate genus.

Actually this sulcation or groove appears to be an elongated areole and the fact that the flowers arise from this point does not necessarily indicate that this is not also the potential spine bearing areole.

The genus was called *Anhalonium* for many years but *Ariocarpus*, which was published by Scheidweiler in 1838, has precedence over Lemaire's *Anhalonium* which was not published until a year later.

Habitat: Texas and Mexico.

Culture: Grown either out of doors or in pots, these species respond to a soil rich in lime which can be added to the standard soil mixture in the form of garden lime or, preferably, of gypsum. Full sunlight is required for all species.

Desirable species: *Ariocarpus fissuratus* (Engel.) Schum., the "Living Rock" of Texas, is easily the most popular species and should form a part of every collection because of its mimicry of a rock. All species are interesting.

In the "Cactus Journal," Vol. IX, pg. 77, I suggested that to this genus be added the genera *Obregonia*, *Strombocactus*, and *Encephalocarpus*, because all of them have in common the horny

tubercles and produce their flowers from near the center of the plant surrounded by copious wool.

Since then, several new species that do not conform to those specifications have been added to *Strombocactus* and the generic description modified to meet the additions, therefore this genus can not now be united to *Ariocarpus*.

Encephalocarpus and *Obregonia* might be united to *Ariocarpus* but this does not seem to meet with popular approval, so they are left as separate genera here.

RECENT INTRODUCTIONS:

To *Ariocarpus fissuratus* (Engel.) Schum., add var. *Lloydii* Rose, comb. nov. Similar to the type but with the horny tubercles rhomboid in shape and not triangular as in the type. The tubercles also turn upwards at the end; flowers purplish-red.

A. retusus Scheid. The description in "The Cacta-

ceae" was based on two or more species and should be corrected to read: Tubercles spreading, short triangular-pyramidal with the upper surface flat, densely covered with grayish bloom, terminating in a horny point; flowers pale pink to flesh colored.

A. furfuraceus (Watson) Thompson. Tubercles triangular, acutely pointed, with a woolly areole on the upper side near the tip of the tubercle, upper side convex, roughened, the lower side keeled; flowers white or pale pink.

A. trigonus (Schum.). Tubercles very numerous, erect, leaf-like, to 2 inches long and to 1 inch wide at base, grayish-green; the upper surface flat, the lower part keeled; the keel acute, horny, this plant greatly resembles a *Haworthia*; flowers white to yellowish.

A. Macdowellii nom. nud. is offered in the trade but is only a small form of *A. Kotschoubeyanus*.

A. elongatus (*Anhalonium elongatum* Salm-Dyck) is also listed but is only a form of *A. trigonus*.

A. scaphostrus Boed. Simple with stem up to about 4 inches thick; tubercles triangular with acute angles and a gray membranous margin, erect, up to 2 inches long; flower purple.

Genus 3. *Strombocactus* Britton and Rose.

A genus of low, globose, or more or less flat plants (Pl. 12: Fig. 3), with or without spines; the rhomboid tubercles, usually flattened, form indefinite ribs in spiralled arrangement; flowers white to whitish, small, borne in the apex of the plant; ovary and fruit with small scales; seeds very small.

The type species of this genus was the only species known to Britton and Rose, who separated it after earlier writers had tried to locate it in five genera of divergent characters.

De Candolle first described the plant as a *Mammillaria* in 1828 and in the same year Pfeiffer transferred it to *Echinocactus*. In 1841 Lawrence included it in his very confusing subgenus *Echinofossulocactus*. Kuntze assigned it to the genus *Cactus* in 1891, but two years later Weber thought it to be in the genus *Anhalonium*.

Two specific names were involved in this moving history; *disciformis* and *turbiniformis* but the plant now rests as *Strombocactus disciformis* (D.C.) Br. & R. Four additional species of recent discovery are now referred here.

Habitat: Mexico.

Culture: A light soil with a high calcium content such as is indicated for *Ariocarpus* is most essential.

Desirable species: *S. disciformis* is obtainable and most representative.

RECENT NEW SPECIES SINCE BR. & R.

Strombocactus lophophoroides (Werd. & Bckbg.) Knuth. Simple, dull grayish-green, about 2 inches in diameter and less in height, deeply embedded in the soil; rootstock thickened; ribs about 12, formed by lozenge-shaped tubercles; areoles from top of tubercles bearing short wool and 3 to 5 short spines, yellowish to grayish; flowers white, to 2 inches in diameter when fully expanded.

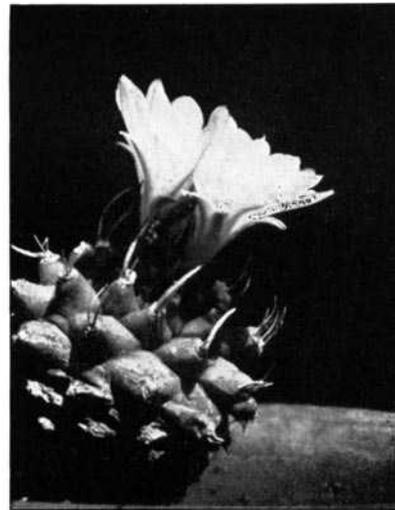


FIG. 85. *Strombocactus Schmiedeckianus* (Boed.) West x 1.5. Photographed by Graham Heid at the Knickerbocker Nursery, San Diego, California.

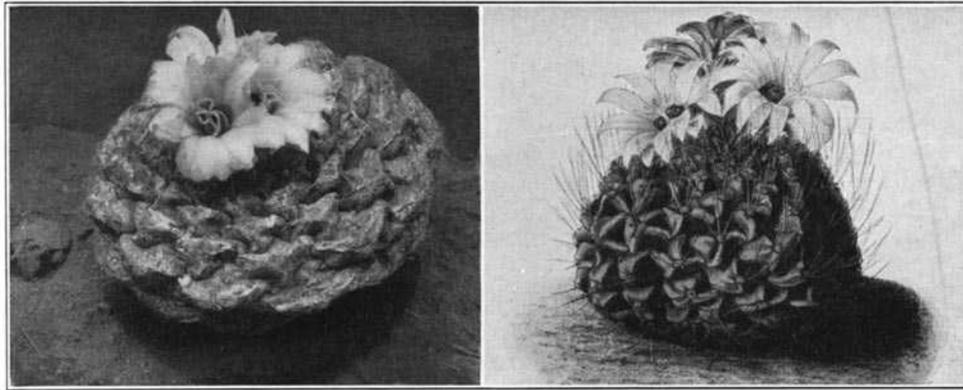
S. macrochele (Werd.) Bckbg. Solitary, flattened globose, small; deep seated in the ground; dull gray-green; tubercles scale-like with elongated areoles bear-

ing white wool and 3 to 5 spines up to 1½ inch long, curved inward, papery in texture, yellowish with dark tips, later gray; flowers white.

S. pseudomacrobele Beckbg., 1935. Similar to the preceding in size and general appearance but the tubercles are rounded, the spines more numerous, bristly rather than papery, brownish and longer; flower

white.

S. Schmiedickeanus (Boed.) West. Simple, ovoid; ribs tuberculate, the tubercles four-angled in 8 to 13 series, spiralled; areoles white woolly when young, later naked; spines 1 to 4 (mostly 3), up to 1 inch long, curved inward, the upper spine flat or grooved, white, blunt; flowers pale pink.



Srombocactus disciformis from "The Cactaceae" shows the plant collected by Dr. Rose. Right: An old picture published in "Blühende Kakteen"

Genus 4. *Obregonia* Fric, 1925

A genus of one species closely allied to *Ariocarpus* from which it differs in its leaf-like, horny, erect tubercles and its funnel-shaped, white flower (Pl. 12: Fig. 4), with naked ovary but with few, short, scales on the upper part of the tube.

Culture: The same as for *Ariocarpus* except that it does not need much direct sunlight.

Obregonia Denegrii Fric, state of Tamaulipas, Mexico. Plant flattened, grayish-green, about 4 inches across; tubercles leaf-like, horny, spirally arranged, almost triangular, flat on the upper surface and keeled below, erect; areoles on the tip of the tubercles at first slightly woolly and bearing a few hair-like spines which soon drop off; flowers from the center of the plant, white, short funnel-shaped, about 1½ inches broad, fruit white, juicy, with the dried flower attached; seeds large, black.

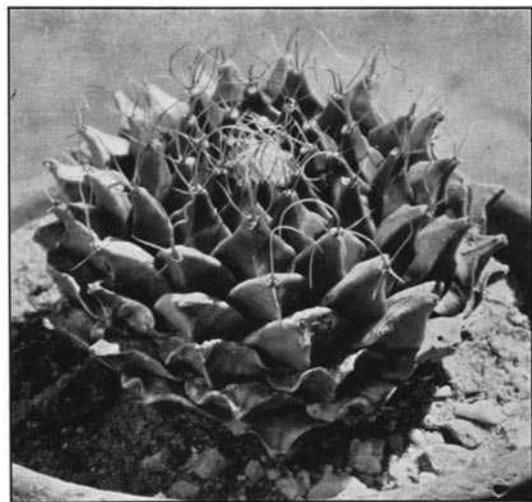


FIG. 86. *Obregonia denegrii* Fric x 1. Graham Heid photo in the author's collection.

Genus 5. *Leuchtenbergia* Hooker, 1848.

A genus of one Mexican species which is absolutely unique in cactus (Pl. 12: Fig. 5). The plant body is cylindrical with a large tap root or sometimes two or more tap roots. Surmounting the body is a group of closely set, finger-like tubercles and these end in an areole from which thin, flat, papery spines arise. These tubercles

gradually dry off and leave broad scars on the plant body. The large yellow flowers arise from the areoles on central tubercles, are fragrant, and last several days.

While rare and expensive, *Leuchtenbergia principis* is most desirable and does well in a loose, rich soil if not over watered.

Genus 6. *Encephalocarpus* Berger, 1929.

A genus of one species which differs from *Ariocarpus* principally in the numerous incurved, scale-like tubercles which are keeled on the back, imbricated, and closely applied to each other, forming a globose stem somewhat resembling a pine cone (Pl. 12: Fig. 6).

The one species *Encephalocarpus strobiliformis* (Werd.) Berger, comes from the state of

Tamaulipas in Mexico. It is about 2 inches in diameter, grayish-green and each of the horny, scale-like tubercles is crowned by a small areole on the inner side, which contains wool and minute spines; the axils of the tubercles are woolly. Flowers near the top of the plant are over an inch broad and violet-pink.

Culture: As for *Ariocarpus*.

Genus 7. *Lophophora* Coulter, 1894.

Syn.: *Anhalonium* Lemaire, 1885.

A genus of interesting plants to which Britton and Rose assigned one species, *Lophophora Williamsii* (Lem.) Coulter. Since then several additional species have been published differing from the type plant in flower color or shape of tubercles but perhaps only varieties of the first species. The plant is small (Pl. 12: Fig. 7), spineless and has a deep conical root or underground extension of the plant body. The small, white to rose flowers are borne near the center of the plant from very woolly areoles.

The generic name of *Anhalonium* was applied to *L. Williamsii* by Lemaire in 1885, who considered it a species of what is now called *Ariocarpus* and the name *Anhalonium Williamsii* still appears in medical and some botanical lists. In 1894, Coulter recognized that this species was not similar in any respect to plants in the genus then called *Anhalonium* and erected the genus *Lophophora* for it.

Habitat: Texas and Mexico.

Culture: A loose, not too rich soil with considerable gypsum added. Water freely in warm weather.

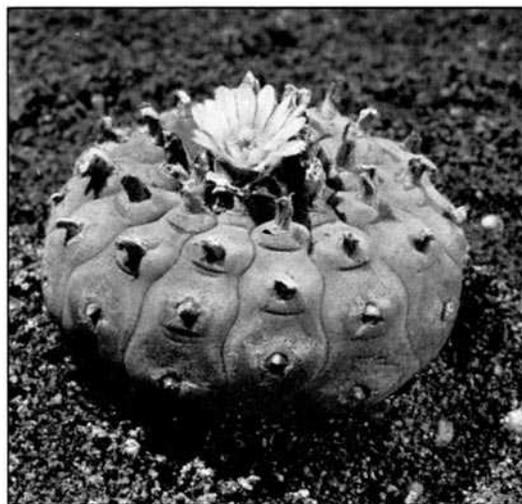


FIG. 87. *Lophophora Williamsii* (Lem.) Coulter x 0.7. Graham Heid photo in the author's collection.

Desirability: As an oddity. Thrives well in pots or will stand considerable cold and wet weather out of doors in temperate localities.

Uses: Three or more alkaloids are extracted and used in chemistry. The flesh of the plant is dried and eaten by Indians in religious ceremon-

ials and it is said to contain alkaloids producing remarkable visions.

Lophophora Lewinii (Hennings) Thompson, while described in 1888, has recently been introduced in the trade as a species. The color is a

yellowish-green and the tubercles are fewer and larger than in *L. Williamsii* and the tufts of wool not so pronounced; flowers white to cream.

Lophophora Tiegleri Werd., seems to be identical with the preceding species or variety.

Genus 8. *Copiapoa* Br. & R., 1922.

A genus of globe-shaped (Pl. 13: Fig. 8), or cylindrical cacti, single or in some cases clustered, the stems ribbed and the top of the plant covered with dense, soft wool. The small, yellow or yellow tinged with red flowers are nearly hidden in this wool. All 10 species are from Chile and are but little known in cultivation.

Culture: The standard 2-1-1 mixture of soil and liberal water in growing seasons is successful for the few species so far introduced.



FIG. 88. *Copiapoa cinerea* (Phil.) Br. & R. x.05. Graham Heid photo in the author's collection.

RECENT NEW SPECIES SINCE BR. & R.

To the six species known to Britton and Rose and described in "The Cactaceae," Vol. III: pgs. 85-89, the following have been added:

Copiapoa Fiedleriana (Schum.) Bckbg., 1903, was described by Britton and Rose in connection with *C. coquimbana* (Kar.) Br. & R., with which they associated it. It may be a distinct species as Backeberg suggests.

C. Malletiana (Lem., 1845) Bckbg., was described in "The Cactaceae," Vol. III: pg. 100, as a possible species of *Neoporteria*, but Backeberg considers it a *Copiapoa* and also states that *Echinocactus pulverulentus* Muehl., 1848, is identical with *C. Malletiana*. Schumann, however, considered *Echinocactus pulverulentus* as related to *E. ceratistes* (now *Eriosyce Ceratistes*) but since it comes from Bolivia, its relationship to either of the Chilean genera seems doubtful.

C. Pepiniana (Schum.) Bckbg., (*Echinocactus Pepiniana* Schum. "Gesamtb. Kakteenk," 1898) not Lemaire, 1846. See "The Cactaceae," Vol. II: pg. 137. Gray-green with 12 ribs; areoles bearing felt which is very profuse at the apex of the plant; radial spines 7, subulate, up to nearly 1 inch long; central spine 1 flower 1 inch long, yellow.

C. taltalensis (Werd. 1931) Bckbg., Taltal, Chile, is another species referable here.

Genus 9. *Coloradoa* Boissevain, "Colorado Cacti," 1940.

A genus with but one known species. Globose to short cylindric plants (Pl. 13: Fig. 9), with ribs formed of confluent tubercles; the funnel-form, bell-shaped flowers from near the center of the plant bear scales on the flower tube but the scales do not have wool, hairs or spines in their axils. The fruit is a naked, juicy berry which bears the withered floral remains and which splits irregularly when ripe.

In general appearance, *Coloradoa* might be mistaken for a plant of the genus *Echinomastus*

but the groove on the tubercles of *Echinomastus*, from which the flowers are borne, is lacking in this genus.

The fruit of *Coloradoa* dehisces by irregular splitting while in *Echinomastus* dehiscence is by a basal pore.

Coloradoa mesae verdae Boissevain is from the Mesa Verde cliffs near Cortez, Colorado.

Culture: A loose, friable soil with considerable lime content is suggested. Water sparingly as the plant is extremely drought resistant.

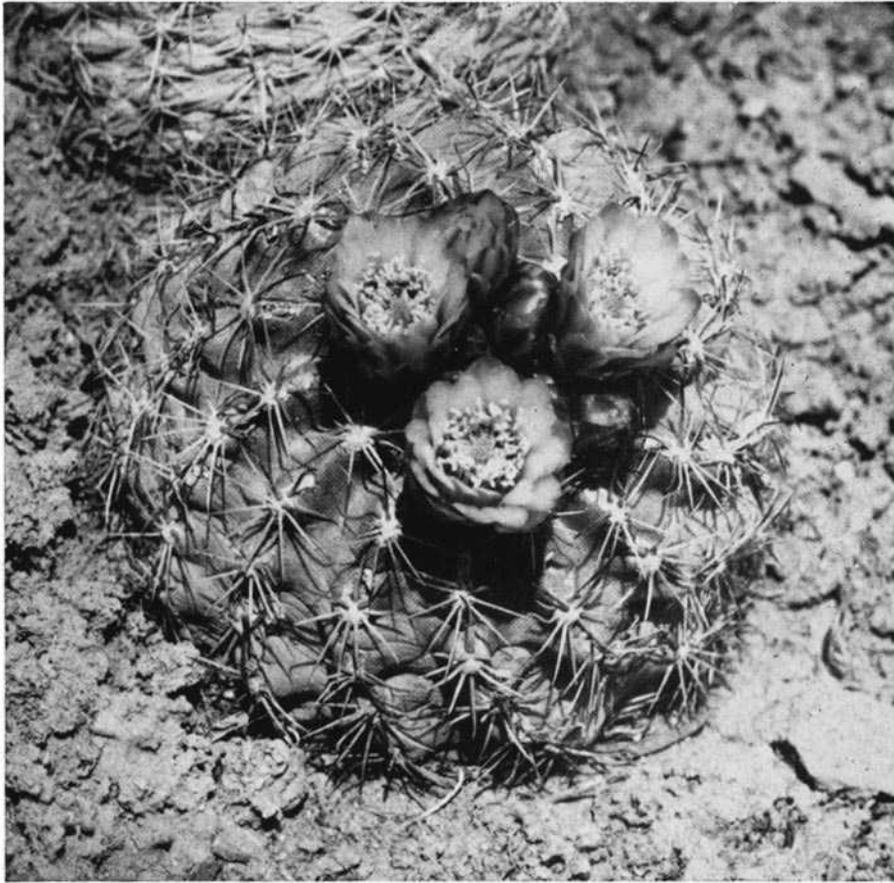


FIG. 89. *Coloradoa mesae verdae* Boissvain x 1. Photo from "Colorado Cacti."

Genus 10. **Pediocactus** Br. & R., 1913.

A genus of but one species which resembles a *Mammillaria* in its tubercled surface, the tubercles in spiralled rib formation (Pl. 13: Fig. 10). The pinkish, funnel-shaped flowers arise from the spine bearing areoles, just above the spines, from tubercles near the apex of the plant. The flower tube bears a few scales which are naked in their axils. The seeds are dull black, tuberculate, keeled on the back with a large sub-basal hilum.

Habitat: Kansas and New Mexico, north to Nevada, Washington, Idaho, and Montana.

Culture: In nature, the plants usually occupy a fairly heavy soil. They receive a lot of moisture in summer, and in winter they are frequently covered by snow.

Desirable species: *Pediocactus Simpsonii* (Engel.) Br. & R., is the type species and is de-

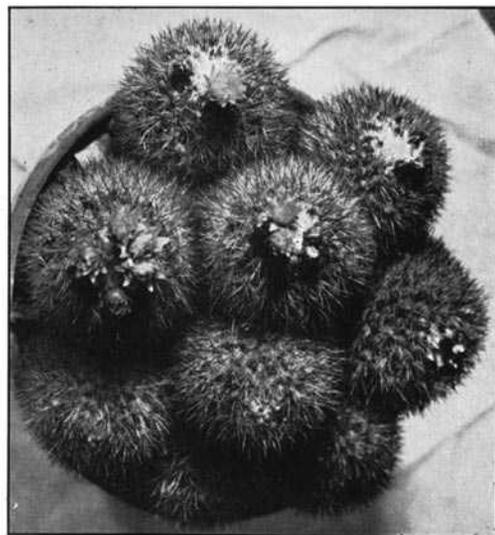


FIG. 90. *Pediocactus Simpsonii* (Engel.) Br. & R. var. *robustior* Coulter x 0.25. Photo by A. S. Harmer, Dieringer, Washington.

pressed globose, and densely covered with white and brown spines.

Var. *minor* Engel., is smaller in every respect, sometimes only 1 inch in diameter. Found in Clear Creek Valley at 8000 to 9000 feet elevations and in Sangre de Cristo Pass at 10,000 feet—both locations in Colorado.

Var. *robustior* Engel. Plant globose cylindrical and larger in all respects than the type and

usually more cespitose, frequently forming mounds of 20 stems or more.

Var. *nigrispina* var. nova. Mentioned in "The Cactaceae," Vol. III: pg. 91. Radials ascending and subulate and nearly black as are also the central spines. Plants usually cespitose, the stems depressed globose. Priests Rapids, Washington. Material for observation supplied by A. and S. Harmer of Dieringer, Washington.



FIG. 91. *Toumeyia papyracantha* (Engel.) Br. & R. x 0.6. From Cact. & Succ. Journ. of Amer. Vol. X: pg. 5 l. Photo by R. H. Peebles.

Genus 11. *Toumeyia* Br. & R., 1922.

A genus of one known species (Pl. 13: Fig. 11) which so greatly resembles a *Mammillaria* that it can be properly identified only when in flower for the flower arises from the upper part of spine bearing areoles and not from the axils of the tubercles as do the *Mammillarias*.

The plant was known only from description until 1936 when Mr. Jack D. Whiteman relocated it (Cact. & Succ. Journ., Vol. VIII: pg. 131). Following this rediscovery the plant became available to collectors and in 1937, (Cact. & Succ. Journ., Vol. X: pg. 51) R. H. Peebles reported that a plant collected in Arizona in 1935 by Col. Dale Bumstead had been identified as *Toumeyia papyracantha*.

The following amended description was made from a flowering plant of the species sent to us by Marion P. Berg, Jr., of Albuquerque, New Mexico.

Plant simple, ovoid to short cylindrical, 7.5 cm. high and 5 cm. in diameter, glaucous green; rootstocks fibrous; tubercles terete, obtuse, in 9/13 series; areoles round, slightly lanate when young; radial spines 8, acicular or slightly flattened, radiating, the lower one distinctly flattened and papery; central spines 3, the middle one ascending, flattened, papery, curved and twisted, the two side ones not so broad, curved inward, all centrals connivent over the top of the plant, the longest about 7 cm. long; all spines

dull, dirty white; flowers from areoles of young tubercles in the top of the plant, 5 cm. long, white; perianth segments lanceolate, translucent white with a greenish-brown median stripe; pistil and stigma lobes greenish; filaments white; anthers pale cream; ovary hemispheric, 3 mm. high, the few scales erose, slightly felted in their axils; fruit dry, globose, smooth; seeds

compressed, black.

Mr. Berg says, "These plants grow under the following conditions: Full sun, loose, fine, gravelly soil, well drained, some lime content; rainfall 7 to 9 inches annually with 4 to 6 inches of snow in winter; temperatures 5 to 105 degrees; found on western slopes of rolling hills amongst bunch grass."

Genus 12. *Epithelantha* Weber, 1898.

A genus of tiny globe-shaped plants (Pl. 13: Fig. 12), containing one species *E. micromeris* and the somewhat larger variety *E. micromeris* var. *Greggii*. The ribs are divided into numerous tiny nipples almost hidden by the numerous, very small whitish spines. The small flowers arise from the spine areoles near the center of the plant and are followed by small club-shaped, ornamental red fruit. The species is commonly

called "Button Cactus" because of its size.

The species is almost white in appearance due to the dense covering of tiny, closely appressed spines, while the somewhat larger variety *Greggii* is grayish with spines neither as short nor as closely appressed as in the species.

Culture: A very loose, sandy soil high in lime content is necessary, and water need not be supplied freely even in growing weather.

Genus 13. *Aztekium* Boedeker, 1929.

A genus of one species, *Aztekium Ritteri* Boed., which resembles *Ariocarpus* but has a very distinct flower (Pl. 13: Fig. 13). Stem globose, depressed, about 2 inches in diameter, sometimes forming small clusters of stems; ribs 9 to 11, olive green, with tiny areoles, closely set, and with horizontal furrows which give the plant a wrinkled or aged appearance; flowers funnel-shaped, white to pinkish; fruit small, pink.

Habitat: First found in the state of Nuevo Leon in northern Mexico, but recently received from Guatemala.

Culture: A mixture of powdered slate and sand is nearest to its natural conditions and has proved very successful. Water freely in warm weather after plant is well rooted.



FIG. 92. *Aztekium Ritteri* Boed. x 1. Photo by Scott Haselton in the author's collection.

Genus 14. *Neoporteria* Britton and Rose, 1922

Syn.: *Chilenia* Bckbg.

Globose to cylindrical, slow growing plants, usually bare at the apex, the ribs more or less tuberculate; flowers funnel-shaped, occasionally produced two or possibly more from an areole

but usually one (Pl. 14: Fig. 14 & 15); ovary and flower tube bearing scales which subtend a greater or lesser amount of wool and woolly hairs or bristles in their axils; fruits small, dehiscing by



FIG. 93. LEFT: *Neoporteria nigricans* (Link) Br. & R. x 0.33. Grafted plants. FIG. 94. Right: Note two flowers from one areole x 0.5. Photos by Scott Haselton in R. W. Poindexter's Nursery, Compton, California.

a basal pore. Type species, *Echinocactus subgibbosus* Haworth.

This good genus was erected by Britton and Rose for those South American globose plants differing from *Malacocarpus* and *Notocactus* in fruits, seeds, and the shape and color of the flowers. They did not notice the tendency of most of the species to produce two or possibly more flowers from one areole but this factor has been observed in four of the seven species they assigned here.

Backeberg, who first observed this characteristic in *Neoporteria subgibbosa* and *N. chilensis*, erected for these two species the genus *Chilenia* despite the fact that international rules prohibit the removal of the type species from a genus, even for the erection of a new genus. This fact was called to his attention by Dr. Werdermann.

Later Backeberg found other species with the multi-flowering habit (Pl. 14: Fig. 14), and placed them in his genus *Chilenia* changing his type species to *Echinocactus senilis* Philippi, which he observed to produce more than one flower from an areole. On October 4, 1940, *Neoporteria nigricans* was observed to have two flowers from one areole on one plant on which all other flowers were borne singly; on another plant of the same species which bore many flowers singly, there was at one areole a twin flower in which the single tube was united to the separate limbs with a pistil surrounded by stamens for each limb and with two ovaries.

This makes four of the seven species, assigned to *Neoporteria* by Britton and Rose, that show more than one flower from an areole as an occasional phenomenon and justifies an addition to the generic description to include the occasional formation of more than one flower from an areole, but does not justify the erection of a genus on this occasional occurrence.

The genus *Bridgesia* was erected for the species *Echinocactus Cumingii* Hopffer (*Lobivia Cumingii* Br. & R.) by Backeberg in 1934, but in 1935 he transferred *E. Cumingii* to his genus *Spegazzinia* and substituted *Cactus villosus* Monville as the type 1 species for the genus *Bridgesia*. Later he removed *C. villosus* from the genus *Bridgesia* and placed it in the genus *Chileniopsis*.

Britton and Rose in "The Cactaceae," Vol. III: pg. 103, describe *Echinocactus villosus* (Monville) Labouret as having a scaly ovary and flower tube, the scales naked in their axils, and therefore consider it as a possible species of *Matucana*. This latter genus, however, has a flower with an oblique limb, similar to the flowers of *Borzicactus*, while *E. villosus* has a short, funnel-shaped flower similar to the flowers in *Neoporteria* except that the scale axils are naked. Several species of *Neoporteria*, notably *N. nigricans*, have so little wool in the scale axils as to be negligible and seldom do the scale axils show hairs or bristles which makes this species (*E. villosus*) so near to *Neoporteria* that I

have not hesitated in following Borg and Berger and consider the species as *Neoporteria villosa* (Monv.) Berger.

From the genus *Malacocarpus*, "The Cactaceae," Vol. III: pg. 191, we take two species doubtfully referred there by Britton and Rose, who knew the plants only from incomplete descriptions—*Neoporteria napina* (Phil.) Bckbg., and *Neoporteria Reichei* (Schum.) Bckbg.

The following species noted by Britton and Rose but unknown to them except by description are now known to belong to the genus *Neoporteria*:



FIG. 95. *Neoporteria nidus* (Sohrens) Br. & R. x 0.5, flowering in R. W. Poindexter's Nursery, Compton, California. Photo by Scott Haselton.

Echinocactus acutissimus Otto and Dietrich "The Cactaceae," Vol. II: pgs. 97 and 99) is now known to be synonymous with *N. subgibbosa* (Haw.) Br. & R.

N. ambigua (Hild.) Bckbg. (*Echinocactus ambiguus* Hild. referred to *Copiapoa cinerascens* in "The Cactaceae," Vol. III: pg. 88).

N. castaneoides (Cels) comb. nov., (*Echinocactus castaneoides* Cels, "The Cactaceae," Vol. III: pg. 99).

N. Fobeana (Mieck.) Bckbg., (*Echinocactus Fobeanus* Mieckley "The Cactaceae," Vol. III: p. 89).

N. Kunzei (Forst.) Bckbg., (*Echinocactus Kunzei* Förster, "The Cactaceae," Vol. III: pg. 99).

N. Odieri (Lem.) Bckbg., (*Echinocactus Odieri* Lemaire, "The Cactaceae," Vol. III: pg. 177).

Habitat: Chile.

Culture: Very slow growing as seedlings, but

a fast growth can be induced by grafting on a strong stock. A rather loose but rich soil is required for seedlings or collected plants with liberal water in growing season.

Desirability: Many species flower early and the flowers are mostly attractive as are also the body forms.

Desirable species: *Neoporteria nidus* (Söhrens) Br. & R., often listed as *N. senilis* Phil., is very attractive. *N. subgibbosa* (Haw.) Br. & R., and *N. nigricans* (Linke) Br. & R., and other species are in plentiful supply and are desirable.

RECENT NEW SPECIES SINCE BR. & R.

Neoporteria Aspillagi (Söhrens 1929) Bckbg. Depressed globose, up to 6 inches in diameter; ribs 15, obtuse; radial spines 4 to 12, up to nearly an inch long; central spines 1 to 4, somewhat longer than the radials; flower less than 2 inches long, rose colored.

N. atrispina (Bckbg.) Marshall. (*Chilenia* Bckbg., 1938). Simple, with tuberous roots over 3 inches in diameter and 6 inches long, separated from the plant by a long, slender neck; body globose, becoming cylindrical, dark green; ribs of confluent tubercles in spiralled arrangement which later become straight ribs with depressions between areoles; spines numerous, acicular or bristly; central spine developing later, rather stiff but not distinct from the radials, black; flowers small, rose-colored.

N. cephalophora (Bckbg.) Marshall. (*Chilenia* Bckbg., 1938). Solitary, globose; rootstocks tuberous; ribs at first with tubercles in spiralled arrangement which later become confluent; areoles with many fine yellow bristles; flowers unknown. As no flowers have been recorded for this species the change from *Chilenia* to *Neoporteria* is based on the nullity of the first genus.

N. heteracantha (Bckbg.) Marshall. (*Chilenia* Bckbg., 1935). Flattened globose, dark in color; ribs about 19; areoles round, closely set; radial spines about 20, bristly, rigid, somewhat curved, nearly an inch long; central spines about 6, up to 2 inches long, dirty white or gray brown; flowers carmine.

N. nigrihorrida (Bckbg.) Marshall. (*Chilenia* Bckbg., 1935). Flattened globose, dark gray green; ribs 16 to 18; areoles round, closely set; radial spines about 16, flatly spreading, over ½ inch long, interwoven, central spines 6 or 7, thick and heavy, spreading, over an inch long, dark silvery gray; flowers 1½ inches long, carmine.

Var. *major* Bckbg. Ribs 13; areoles large, oval; radial spines 18, subulate, curved at apex; central spines 10, robust, rigid.

Var. *minor* Bckbg. Smaller plant; radial spines 16, short; central spines 8, ½ inch long, dark green; ribs 16; radial spines flexible, interlaced; central spines about 6, unequal, interlaced, at first dark brown, later straw-colored, finally becoming gray; flower not described.

Genus 15. **Arequipa** Br. & R., 1922.

A genus of one or possibly two species from Peru (Pl. 14: Fig. 16), with red, rather oblique flowers which place it close to *Cleistocactus*, *Borzicactus* and *Matucana*, the latter sharing the habit of *Arequipa* of becoming cylindrical in age and attaining a height of two feet or more. *A. leucotricha* (Phil.) Br. & R., requires a rather rich, loose soil in cultivation and, is quite hardy. It does well grafted.

Borg lists *Echinocactus clavatus* Söhrens, 1900, as a separate species but his description suggests a more mature form of *A. leucotricha* which changes considerably in spining and ribbing when fully grown, as is indicated by the photo of a grafted plant in flower on this page.

Br. & R. list *A. miriacantha* as based on Vaupel's *Echinocactus myriacanthus* but all later writers consider this a synonym of *A. leucotricha*.

Genus 16. **Oroya** Br. & R., 1922.

A depressed globe-shaped (Pl. 14: Fig. 17), low, ribbed species. *Oroya peruvianus* (Schum.) Br. & R., constitutes this genus although another species, *O. neoperuviana* Bckbg., 1935, has been described which may be only a variety.

Genus 17. **Matucana** Br. & R., 1922.

The one species, *M. Haynei*, is densely white-spined (Pl. 14: Fig. 18). At first globe-shaped, it becomes cylindrical in age. The red, diagonal

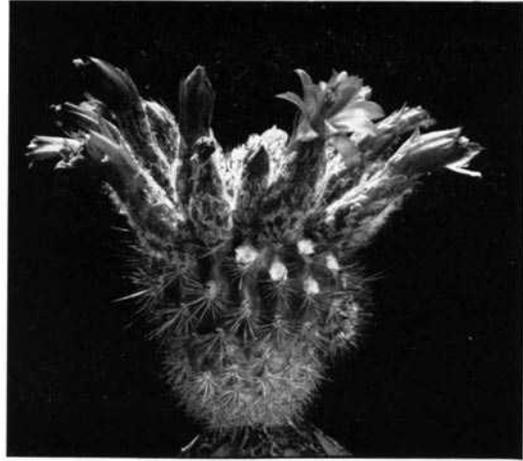


FIG. 96. *Arequipa leucotricha* (Phil.) Br. & R. x 0.5, flowering in the collection of R. W. Kelly, Temple City, California. Photo by Graham Heid.

The spines are long and widely spreading and the flowers, which arise near the center of the plant, are short funnel-form and red to pink. The tube and fruit are without spines or bristles. The plant body is drawn underground.

flowers arise from near the center of the plant. It grows best when it is grafted on a hardy stock.

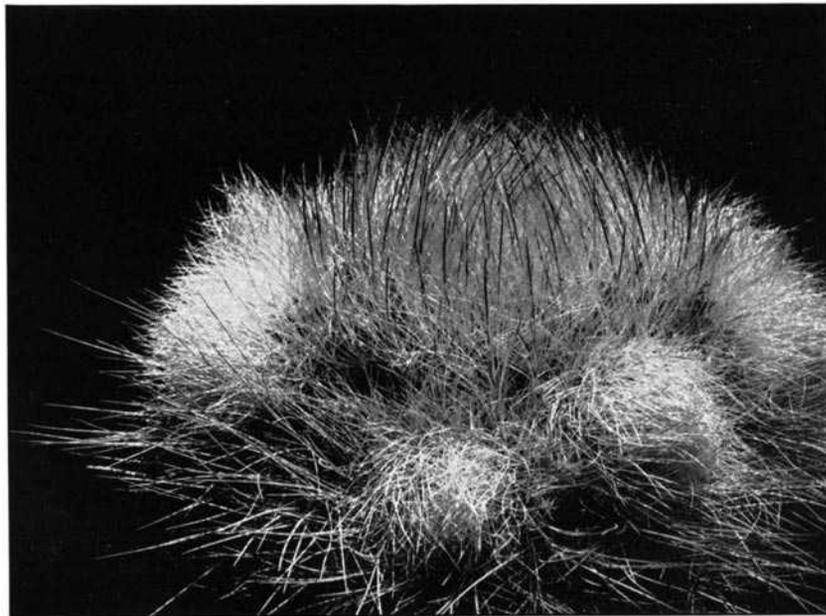


FIG. 97. *Matucana Haynei* (Otto) Br. & R. x 0.5. Photo by Scott Haselton in R. W. Poindexter's Nursery.

Genus 18. *Hamatocactus* Br. & R., 1922.

Globose to short cylindrical, distinctly ribbed (Pl. 15: Fig. 19), sometimes strongly tubercled; areoles elongated, oval and woolly; spines radial and central, usually one of them hooked; flower buds pointed, covered with imbricating scales; flowers funnel-shaped with a narrow tube and broad limb; scales on the ovary few, naked in their axils; fruit small, oval, red or green, seeds black.

Britton and Rose erected the genus on one species, *Hamatocactus setispinus* (Engel.) Br. & R., but all later writers seem to concur in the opinion that Muehlenpfordt's *Echinocereus hamatacanthus* should also be included.

In "The Cactaceae," Vol. III: pg. 145, attention is called to several factors in connection with this species that tend to make it doubtful as a *Ferocactus* to which it is there assigned. We consider it as *Hamatocactus hamatacanthus* (Muehl.) Borg.

Brittonia Davisii assigned to Houghton, an undescribed genus and species, is referable here as a variety having more pronounced tubercles which form rounded prominences projecting from the flattened ribs. In flower and fruit, it is identical with *H. hamatacanthus* and should be placed as *Hamatocactus hamatacanthus* (Muehl.) Knuth var. *Davisii* var. nov.



FIG. 98. *Hamatocactus hamatacanthus* (Muehl.) Borg var. *Davisii* x 0.33, showing flower buds from upper part of areoles. Photo by Oliver Young, Bridgton, Maine.

Genus 19. *Weingartia* Werdermann, 1939.

The genus *Spegazzinia* was first erected by Backeberg to care for two species of cacti from the Argentina-Bolivia border. As first outlined, the rootstocks of the species were made a generic character. These rootstocks were beet-like and separated from the body of the plant by a neck. As a generic character this was of doubtful value as similar rootstocks are noted in *Opuntia subterranea* Bckbg., *Thelocactus subterraneus* Bckbg., *T. mandragora* (Fric) Berger, and similar rootstocks in clusters in species of *Wilcoxia*. Later the rootstocks were abandoned as a generic character and the perambulating species, *Echinocactus Cumingii* Hopffer was added to the genus.

Werdermann called attention to the prior use of *Spegazzinia* as a generic name by Saccardo in 1886, which invalidated its use here and he proposed *Weingartia* as a substitute name.

As now considered, the genus is composed of

globose to cylindrical plants (Pl. 15: Fig. 20) of South American origin with beet-like roots separated by a thin neck in two species, ribbed or tubercled, the tubercles distinctly chinned; flowers yellow to orange in color, with very short tubes; ovaries bearing small scales that are without content in their axils.

Habitat: Argentina, Bolivia and Peru.

Culture: The species do best when grafted on sturdy stock and are not grown on their own roots, as far as we know, in this country.

Desirability: As the species are rather shy bloomers in this country, they are to be considered principally as collectors' items.

Weingartia Cumingii (Hopff.) Werd., was first described as *Echinocactus* by Hopffer in 1843. Britton and Rose, who knew the plant from confusing descriptions only, doubtfully referred it to *Lobivia* ("The Cactaceae," Vol. III: pg. 59). Backeberg erected the genus *Bridgesia*

for this species but later transferred it to *Spegazzinia*.

RECENT NEW SPECIES SINCE BR. & R.

Weingartia Fidaiana (Bckbg.) Werd., 1933. Simple or offsetting from the upper areoles; turnip-like rootstock; body globose to cylindrical, gray-green; ribs 14, strongly tuberculate; areoles large, round, woolly; radial spines about 9, thick but flexible, straw-yellow to violet-black, over an inch long; central spines 3 or 4,

spreading, somewhat recurved, up to 2 inches long; flowers cadmium yellow.

W. Neumanniana (Bckbg.) Werd., 1935. Large tuberous rootstocks; body globose, dull dark green; ribs formed by confluent tubercles in spiral arrangement; tubercles angled, at first with much yellowish-white wool at the large areoles; radial spines about 6, yellow to black, nearly an inch long; central spine 1, out-curved, same color as the radial spines, up to 1½ inch long; flowers orange.

Genus 20. *Stenocactus* Schumann, 1898.

Syn.: *Echinofossulocactus* Lawrence, 1841.

Relatively small, globose plants (Pl. 15: Fig. 21) with many ribs, the ribs usually thin and wavy with few areoles; spines not hooked, usually flat and papery, frequently entirely covering the plant; flowers small, from top of plant, pink, lavender, cream to yellowish, with a short tube; fruit with papery scales.

These plants were included in the genus *Echinocactus* of Schumann's classification, but under the subgenus *Stenocactus*. Britton and Rose selected an old subgeneric classification of the horticulturist Lawrence, who, in 1841, included some of the species as well as many non-related species in his subgenus *Echinofossulocactus*. Lawrence's subgenus cannot be considered a botanical entity because of the inclusion of such unrelated material, although the genus as erected by Britton and Rose was amended to suit the plants which they included. Their genus was erected in 1924 and is superseded by Schumann's earlier classification. The genus *Brittonrosea* was proposed by Spegazzini in 1923 for these plants but the name, while having priority over the *Echinofossulocactus* of Britton and Rose, was antedated by Schumann's *Stenocactus*.

Britton and Rose included 22 species in their genus and all of these are retained in the genus *Stenocactus* as well as a few plants of newer discovery.

Dealers now offer over 100 names under this genus. Most of these names were included in the synonymy of the species recognized by Britton and Rose, and their conclusions were sound and must be retained. Further careful study may possibly reduce the number of valid species in this genus.

Habitat: Mexico.

Culture: A well drained soil is the only requisite. They are fairly hardy and frost resistant, do well in sun or shade, take water or leave it alone,

and are among the first cacti to flower in the spring.

Desirability: As many species as possible should be the aim of lovers of attractive, free-flowering plants.



FIG. 99. *Stenocactus acroacanthus* (Stieber) x 0.5. Photo by R. H. Lahmeyer, Fort Wayne, Indiana.

Desirable species: *Stenocactus multicostatus* (Hild.) Berg., is a temperamental plant even though one of the most attractive species and is the least desirable because of the difficulty of culture. Any of the other species are desirable.

RECENT NEW SPECIES SINCE BR. & R.

Stenocactus Boedekerianus Berg., 1929, Zacatecas. Globose, flattened, dark green; ribs about 40, undulate; areoles circular, distant, bearing white wool; radial spines about 20, spreading, acicular, white; central spines about 9, all bulbous at base, flattened, annulate, yellowish-brown with brown tips, up to 2 inches long, erect; flowers unknown.

S. Bustamantei Bravo, 1937, Hidalgo. Globose to 4 inches in diameter; ribs about 35; radial spines 8 or 9,

horizontally spreading, imbricated, whitish, about $\frac{1}{2}$ inch long; central spines 3, the upper one up to 2 inches long, flattened, annulate, the lateral ones grayish with darker tips; flower about 1 inch long, white with a dark midrib.

S. Lexarzaei Bravo, 1937, Hidalgo. Globose, ribs 40 to 50, somewhat undulate; radial spines usually 8, sometimes 10, horizontally spreading, about $\frac{1}{3}$ inch long, acicular, white; central spines 4, the upper one flattened, annulate up to $2\frac{1}{2}$ inches in length; connivent over the plant, grayish, the lower ones less than an inch in length, flattened, up to 1 inch long, grayish with a darker tip; flowers over 1 inch in length, rose colored.

S. Ochoterenaus (Tiegel) Bravo, 1933, Guanajuato and Queretaro. Simple, globose, blue-green; apex rounded, at first with yellow wool; ribs about 30, undulate; areoles distant, circular, bearing yellow wool

when young; radial spines 22 or more, bristly, straight or curved, white, equal, about $\frac{1}{2}$ inch long; central spines 4, flattened, the upper one nearly 2 inches long, the lateral ones flexible, all centrals golden yellow; flowers whitish.

S. tetraaxiphus (Otto) Berg., was considered by Britton and Rose as identical with *S. heteracanthus* (Muehl.) Br. & R., but later writers consider it a good species even though there is little difference in the descriptions of the two plants.

S. Vaupelianus (Werd.) Knuth, 1931. Simple, half globular, dull green; ribs 30 to 40, undulate; areoles at first with white wool; radial spines 12 to 25, radiating, acicular, white, sometimes dark tipped; about $\frac{1}{2}$ inch long; central spines 1 or 2, up to nearly 3 inches long; subulate or flattened, straight or incurved, brownish-black to reddish-brown; flowers cream colored with dark midrib.

Genus 21. *Ferocactus* Br. & R., 1922.

The plants of this genus are commonly called "Barrel Cactus" because of the barrel shape of the stems of many species, one of which attains the immense size of 12 feet in height and 4 feet in diameter. The globe-shaped or cylindrical stems are ribbed very prominently (Pl. 15: Fig. 22), and the areoles on the ribs bear spines, either straight or hooked. The funnel-shaped or bell-shaped flowers arise near the center of the top of the plant. The ovary and short flower tube are very scaly but not spiny. The dry fruit is oblong in shape with very thick walls, and drops its seeds when ripe through a hole in the bottom of the fruit. About 30 species are known.

Britton and Rose, who erected the genus, doubtfully assigned to it several species of diverse habits. One of these, *Echinocactus un-*

cinatus Gürke, we refer to the genus *Thelocactus* because the flowers are borne at the base of a groove on the pronounced tubercles, and the seeds are attached by a basal hilum. Borg assigned this species to the genus *Hamatocactus*, from which it is excluded because of this flowering habit.

Echinocactus Johnsonii Parry, we unhesitatingly refer to the genus *Echinomastus* because of a similar flowering habit but with ventral attachment of seeds. *E. crassihamatus* Weber, we propose to refer to the genus *Thelocactus* (see *Thelocactus*).

Ferocactus Rostii Br. & R., does not differ greatly from *F. ancanthodes* (Lem.) Br. & R., which assumes a tall, slim, cylinder shape in var-

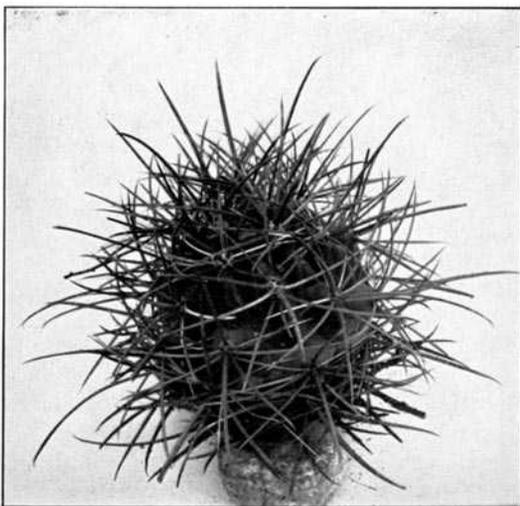


FIG. 100. Juvenile form of *Ferocactus acanthodes* (Lem.) Br. & R. x 0.33. Photo by Scott Haselton.

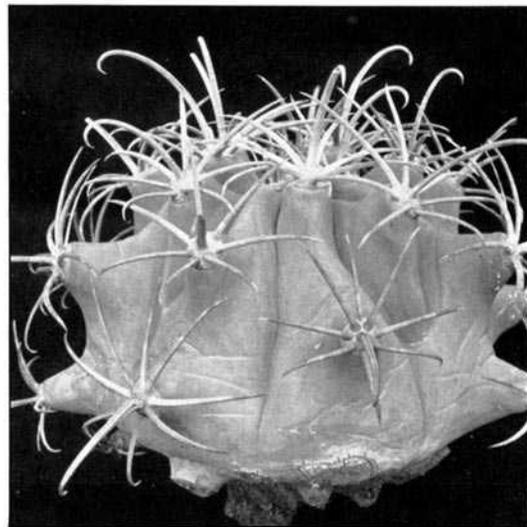


FIG. 101. Juvenile form of *Ferocactus Covillei* Br. & R. x 0.5. Photo by Scott Haselton.

ious districts of its range. It should be referred to that species as a variety, thus: *Ferocactus acanthodes* (Engel.) Br. & R., var. *Rostii* comb. nov.

F. horridus Br. & R., from San Francisquito Bay in Baja California, has not been certainly

identified. When it is, it may prove identical with Gates's species, *F. coloratus*, *F. gracilis* or *F. viscaimensis*, from Baja California. Pending further investigation, these species are here considered as valid and are listed.

F. Lecontei (Engel.) Br. & R., is based on Engelmann's *Echinocactus Lecontei*, a species he reports as found along the 35th parallel from the Bill Williams River, in Arizona, through the Mojave Desert of California to a point where it meets *Echinocactus polycephalus*. The plant found in that district is *Ferocactus acanthodes* and this name (*F. Lecontei*) is therefore a synonym of *F. acanthodes*.

Habitat: Mexico and United States.

Culture: Most successful in outdoor cultivation and usually very frost resistant if allowed to dry off. Do not use very rich soil. Good in greenhouse cultivation if watered sparingly. Easily grown from seed, but requires years to flower.

Uses: From plants of this genus the weary desert traveller can get so-called water by mash-

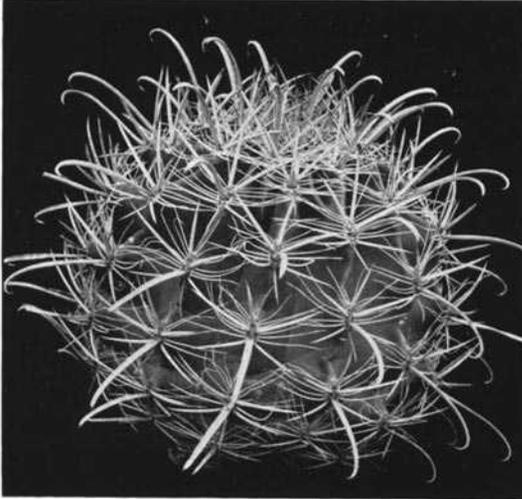


FIG. 102. Juvenile form of *Ferocactus wislizeni* (Engel.) Br. & R. x 0.33. Photo by Scott Haselton.

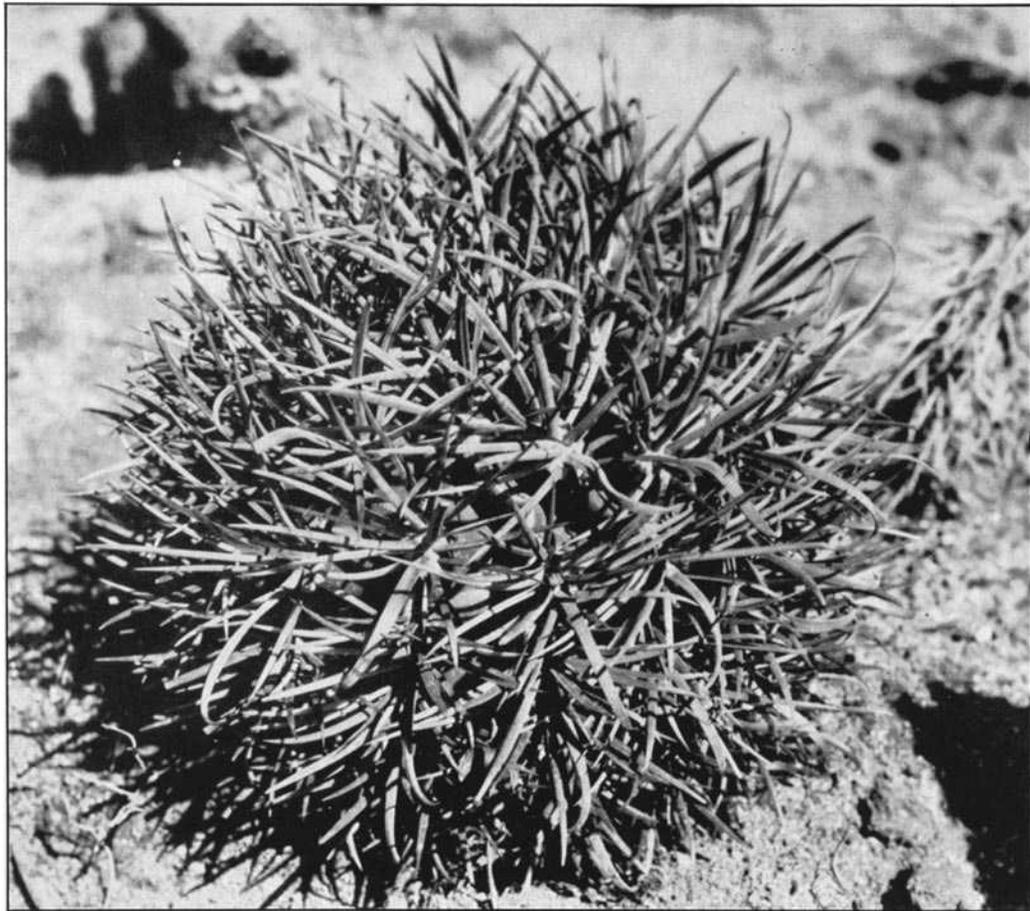


FIG. 103. *Ferocactus chrysacanthus* (Orcutt) Br. & R. x 0.5. Photo by George Lindsay.

ing the very juicy pulp into an unpalatable alkaline drink. The heavy, hooked spines are usable as fishhooks. The flesh is used for candy making, but this should be discouraged, since fifty to one hundred years are required to produce a mature *Ferocactus*; better vehicles for candy making are found in vegetables or fruit.

Desirable species: Ferocactus latispinus (Haw.) Br. & R., *F. nobilis* (Lem.) Br. & R., and *F. alamosanus* Br. & R., are easier to grow than are other species of this genus and are therefore to be selected if only a few species are desired.

F. rectispinus (Engel.) Br. & R., is attractive because of the very long, straight central spines which attain a length of 8 inches or more and resemble hat pins.

RECENT NEW SPECIES SINCE BR. & R.

Ferocactus coloratus Gates, 1933, Baja California. Simple, globose to sub-cylindrical, up to 3 feet high; ribs at first 13, increasing to 20; areoles large, ovate, not distant; radial spines 10 to 14, bristly, spreading and somewhat curved; central spines 9, spreading, annulate, stiff, bright brownish-red, all straight except the lower middle one which is flattened, $\frac{2}{3}$ inch wide and up to 2 inches long, porrect, tips recurved or hooked; flowers straw-yellow with a reddish purple midrib.

Genus 22. *Neowerdermannia* Fric, 1930.

A newly discovered genus of globose cacti (PI 15: Fig. 23) from the high mountains of Bolivia and Argentina. In nature the deep-seated plants withdraw deeper into the ground with the approach of cold weather. The plants are eaten by the natives who peel them and boil or roast the stems. The chin-like tubercles do not bear the spines from the apex but from areoles located at the base, and from these same areoles arise the naked flowers and fruit.

The two species are:

Neowerdermannia Vorwerkii Fric, 1930, Argentina. Globose with a thickened tap root; ribs about 10, composed of three cornered tubercles; areoles at the base of the tubercles; spines all radial, about 10, sharp, curved, divergent, at first dark to reddish-brown; flowers white with lilac pink stripe.

N. Vorwerkii var. *Gielsdorfiana* Beckbg. Tubercles rounded; flowers lilac pink, rotate.

N. chilensis Beckbg., *Cact. & Succ. Journ. of Amer.*, November, 1936, Chile and Bolivia border. Simple, depressed globose with a carrot-like root, stem gray-green to brownish-olive; ribs about 15; areoles white woolly; radial spines about 20, flexible, nearly an inch long, gray, one often twisted at the point and almost hooked; central spine 1, straight, subulate, stiff, erect, violet-brown; flowers unknown.

F. gracilis Gates, 1933, Baja California. Simple, globose to cylindrical, up to 9 feet high and 1 foot in diameter; ribs 24, tuberculate; areoles narrowly elliptical; radial spines usually 10, spreading, acicular, whitish, 1 inch or more in length; central spines 7 to 13, subulate, except the upper middle one which is ascending, flattened, and the lower middle one which is flattened or concave above, sometimes hooked, annulate, dull dark red, becoming black, appressed and interlocking in age; flowers straw-yellow, maroon mid-stripe.

F. Herrenae Ortega, 1927, southern Sinaloa and Durango, Mexico. Globose to cylindrical, up to 6 feet high; ribs 13 to 14, at first tuberculate; areoles elliptical, nearly an inch long, bearing white felt; radial spines 8, reddish when young; central spine 1, at first somewhat hooked, later straight, over 1 inch long; $2\frac{1}{2}$ inch funnel-form flowers, yellow with red center.

F. tortulospinus Gates, 1933, Baja California. Originally described without flowers, has later proved to be a variation of *F. acanthodes*.

F. viscaïnensis Gates, 1933, Baja California. Clavate, to $4\frac{1}{2}$ feet high; ribs 13 to 21, thin, undulate; areoles large, elliptical; radial spines usually 8 but sometimes 4 or 2, weak or stiff, acicular, grayish; central spines 5 to 9, stiff, robust, annulate, dull grayish-brown, all sharp except one in the direct center, which is up to 5 inches long, flattened, strongly hooked; flowers about 2 inches long; straw yellow with purple central stripe.

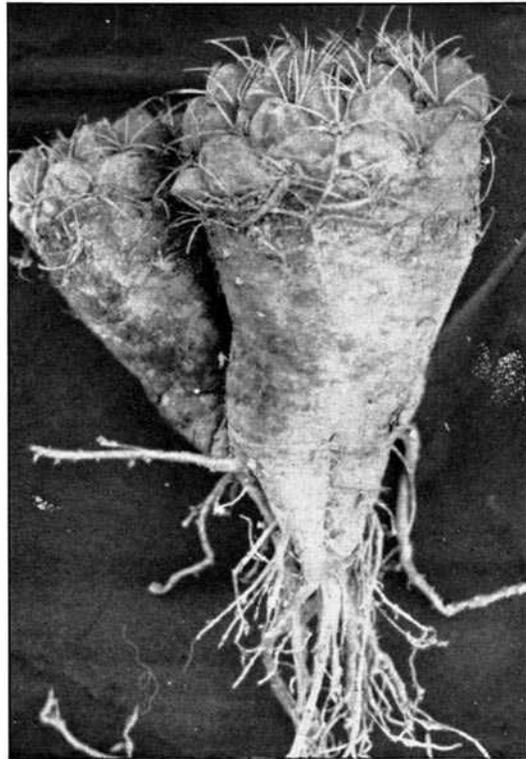


FIG. 104. *Neowerdermannia Vorwerkii* Fric x 0.5. Photo from Martin Cardenas, Bolivia.

Genus 23. *Gymnocalycium* Pfeiffer, 1845.

A genus to which Britton and Rose assigned twenty-three species but to which many more are now referred. The plants are globe-shaped (Pl. 15: Fig. 24), usually single, but sometimes clustered, rather small, ribbed, but with the ribs broken into tubercles. The bell-shaped to short, funnel-shaped flowers arise from near the center of the plant and are large in comparison with the size of the plant and are white, greenish, yellow, pink, or red. The flower tube bears broad scales but no spines, wool, or bristles. The generic name, *Gymnocalycium* is from two Greek words meaning "naked" and "bud" referring to the spineless flowers.

All species referred here by Britton and Rose are considered valid. Their *Gymnocalycium Spegazzinii* was applied to the plant generally known as *G. lorincatum* (Speg.) Knuth, and the latter name has precedence.,

Gymnocalycium Quehlianum (Haage Jr.) Berger, was considered as identical with *G.*

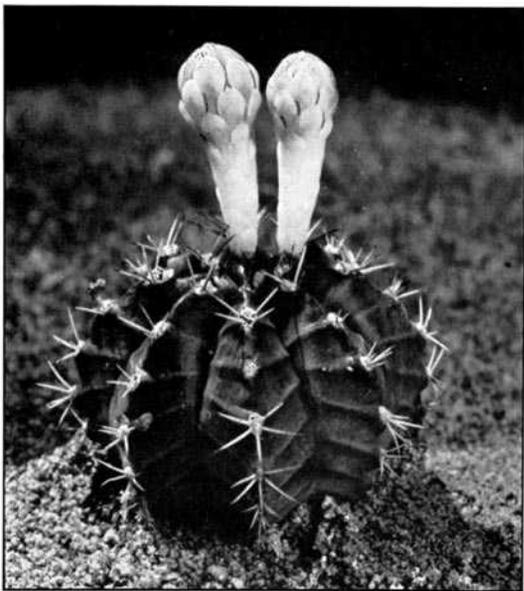


FIG. 105. *Gymnocalycium Mihanovichii* (Fric & Gürke) Br. & R. x 1. Photo by Graham Heid.

platense (Speg.) Br. & R., but all later writers have considered them as distinct even though there is but little difference in the descriptions of the two plants.

To *Gymnocalycium denudatum* (Link & Otto) Pfeiff., the following varieties should be added:

Var. *Bruennowii* Haage Jr., more ribs (12).

Var. *paraguayense* Haage Jr., more prominent ribs.

Var. *roseiflorum* Hild., inner petals pink.

To *Gymnocalycium gibbosum* (Haw.) Pfeiff., add:

Var. *Rümpleritosum* Hort., freely branching at base.

Var. *ferox* Lab., more slender, tubercles 4 angled, spines more numerous, 1 inch long, flexible, yellow and red at base when young.

Var. *leucacanthum* Schum., ribs 19, spines reddish-white at base.

Var. *nobilis* Schum., plant thicker, more pronounced tubercles, larger areoles, up to 25 radial and 6 central spines, all straight, white with ruby red base.

Var. *leonensis* Hild., plant slender and with fewer ribs.

To *Gymnocalycium multiflorum* (Hook.) Br. & R., add:

Var. *albispinum* Schum., spine red at base, pure white above, thick and curved.

Var. *hybopleurum* Schum., shorter with thicker ribs, strongly tubercled, spines fewer, flower white, speckled red at base.

To *Gymnocalycium Schickendantzii* (Weber) Br. & R., add:

Var. *Delaetii* Schum., tubercles more rounded, flowers longer, the bud reddish.

Habitat: Chiefly from Argentina.

Culture: Plants of this genus require a loose soil of considerable richness and prefer partial shade. They respond to liberal watering in warm weather and most species are hardy. Many will stand temperatures somewhat below freezing. Can be grown in pots.

Desirability: The seedlings chiefly available are very free growers and do well on their own roots or grafted. Recommended to beginners for ease of cultivation, profuse flowers and remarkable appearance of the plants.

Desirable species: *Gymnocalycium Mihanovichii* (Fric & Gürke) Br. & R., easily is the favorite, but *G. denudatum* (Link & Otto) Br. & R., *G. saglione* (Cels) Br. & R., *G. kurtzeanum* (Gürke) Br. & R., and *G. Damsii* (Schum.) Br. & R., are available and most interesting. In fact any species of this genus is well worth while.

RECENT NEW SPECIES SINCE BR. & R.

Gymnocalycium Andraea (Boed.) Werd. & Bckbg., Cordoba, Argentina. Globose, slightly flattened, dark to bluish-green, branching from base; ribs about 8, flat, divided into roundish tubercles; radial spines about 7, flatly spreading, acicular slightly curved, white, short; central spines 1 to 3, similar to radials but curved upwards and dark brown; flower sulphur-yellow.

G. albispinum Bckbg., 1935, Cordoba, Argentina. Globose, somewhat flattened; ribs 14, tuberculate; areoles round, bearing white felt; radial spines about 25, short, brownish; central spines usually wanting; flower lilac-rose.

G. bodenbenderianum (Hoss.) Berg. Disc-like, about 3 inches broad, brownish to grayish-green; ribs 11 to 14, low, broad, tuberculate; areoles round, bearing grayish wool; spines all radial, 3 to 5, stiff, curved backward, black at first, later grayish-brown; flowers white with a pink flush.

G. brachypetalum (Werd.) Speg., Argentina. Almost cylindrical to 4 inches high and 3 inches in diameter, dark bluish-green; ribs 13, tuberculate; areoles elongated and bearing ashy-white wool; spines 5 to 7, all radial, spreading, acicular, yellow to gray, up to 1 inch long; flower 2 inches long, white.

G. Bruchii (Speg., 1933) Bckbg., *G. lafaldense* Vaupel, 1934, Argentina. (*Frailea* Speg.). Body small, densely proliferous; ribs 12, low tuberculate; areoles elliptical bearing white wool; radial spines 6 to 12, very short, spreading, curved, bristle-like, white; central spine sometimes 1 often wanting, straight and darker than radials when present; flowers over an inch long, pinkish-white with pale violet-rose center stripe.

Var. *Hossei* Bckbg., 1935. Spines flesh pink or darker, heavier than in the type; flower somewhat larger and petals looser.

G. capillense (Schick., 1927) Bckbg. Resembles *G. platense* and possibly a mere variety of that species with 5 spines and pinkish flowers.

G. Castellanosii Bckbg., 1935, North Argentina. Simple, blue-green, globose; ribs 10 to 12, flattened; areoles distant, bearing thick, white felt; radial spines 5 to 7; central spine one or wanting; all spines white with dark tips; up to 1 inch long, straight, porrect; flowers whitish with a pink sheen.

G. chubutense Bckbg., is *G. gibbosum* var. *chubutense* Speg., 1902.

G. Delaetii Schum., 1901, is a variety of *G. Schickendanzii* (Weber) Br. & R.

G. Fleischerianum Jajo, 1934, is *G. Anisitsii* (Schum.) Br. & R.

G. grandiflorum Bckbg., 1935, is near to and possibly co-specific with *G. Kurtzianum* (Gürke) Br. & R.

G. hybopleurum, Bckbg. (*Echinocactus multiflorus* var. *hybopleurus* Schum., 1898), is referable to *G. multiflorum* (Hooker) Br. & R.

G. immemoratum Castell & Le Long, 1939, Argentina. Depressed-globose, dark green, cespitose; ribs 10 to 13, tuberculate; areoles in depression of tubercles, elliptical and bearing gray wool; radial spines about 15, of which 4 are sometimes central, bulbous at base, an inch or more long, chestnut brown with gray tips, curved to the left and imbricated; flowers white with a purple mid stripe.

G. leptanthum Speg., Argentina. Small, flattened globose, dark green; ribs 9 to 12, tuberculate; areoles round, bearing white wool; spines all radial, 7 to 9, whitish, bristly, curved over the tubercles, short; flowers white.



FIG. 106. *Gymnocalycium flatted* at R. W. Poindexter's Nursery, Compton, California, x 0.5. Photo by Scott Haselton.

G. nigriareolatum Bckbg., 1934, Argentina. Simple, globose, pale green; areoles bearing thick white wool at first, later becoming black; radial spines about 7, pale pink, slightly curved; central spine 1, slightly longer, curved upward; flowers white.

G. nidulans Fric. Globose, brownish-gray; ribs about 17, tuberculate; areoles oblong, bearing yellowish-gray wool; spines all radial, about 6, rigid, somewhat curved; flowers pinkish.

G. Ochoterrenai Bckbg., 1935, Argentina. Flattened-globose, olive green tubercles tinged with brown; ribs about 16, tuberculate; areoles with short felt; spines all radial, 3 to 5, appressed, horn-colored to whitish-yellow with darker tips; flowers white with pinkish throat.

G. oenanthemum Bckbg. Simple, globose, dull pale green; ribs about 11, rounded, tuberculate; areoles oval with yellowish wool; 5 spines all radial, up to ½ inch long, reddish, slightly curved; flowers 2 inches long, petals pale coppery red.

G. Pflanzii Vaupel, 1924. Depressed globose; ribs tuberculate; areoles with short wool; spines all radial 8 or 9, spreading, curved, short, porrect; flowers salmon. Very similar to *G. saglione* but with fewer and shorter spines and longer and more pointed flower buds.

G. prolifer Bckbg., (also written *proliferum*). Cespitose, globose, bright green; ribs about 11, low, tuberculate; areoles bearing yellowish felt; spines all

radial, about 9, appressed, short, yellow to whitish; flowers whitish to pink or brownish-white with red throat.

Var. *calochlorum* Bckbg., (*G. calochlorum* Boed.). Yellow-green, areoles small with but little felt, top of plant bare.

G. rhodantherum Boed., 1934, (*G. mazanense* Bckbg., 1935). Flattened-globose, simple, dull gray-green; ribs 19 to 21, low, tuberculate; areoles distant, with copious white wool; radial spines about 7, pinkish-gray, curved, about 1 inch long; central spines 1 or 2, up to 1½ inches long; flowers rose colored.

G. sanguiniflorus Werd., 1932, is referred to *G. Venturianum*.

G. Sigelianum (Schick.) Berg., 1927. Globose, grayish-brown or greenish-brown; ribs 10, slightly tuberculate; areoles with some white wool; spines 3, the lateral two about ¾ of an inch long, straight or slightly curved, the lower one slightly longer, curved upward; flowers not described.

G. stellatum Speg., 1905. This species is identical with *G. Bodenbenderianum* Berg., except that the

flowers are said to open wider with more slender and longer tubes and larger and longer fruit. If this is so, Spegazzini's name is the older publication and *G. Bodenbenderianum* should be a variety only.

G. Velenowskyi Speg., Argentina. Flattened globose, shining grass green; ribs 20 or more, tuberculate; areoles round, bearing abundant white wool when young; radial spines 9 to 12, short, yellow with reddish tips, straight or curved; central spines 1 to 4, the lowermost up to 1 inch long, curved and directed downward, the others shorter and directed upward, bulbous at base, base red, center of spine yellow with red tips; flower glossy, golden yellow.

G. Venturianum (Fric) Bckbg., (*G. venturi* Fric 1929, and *Echinocactus sanguiniflorus* Werd. 1932). Simple, depressed globose, pale bluish-green; areoles small, round; ribs 9, broad, rounded; radial spines 5, yellowish, appressed, short; central spine wanting; flowers bright carmine.

G. Weissianum Bckbg., 1935, Argentina. Depressed-globose, gray-green; ribs about 19, flat; areoles distant, bearing felt; radial spines 8, up to an inch or more long; central spine 1; flowers rose colored.



FIG. 107. *Echinocactus platyacanthus* L. & O. x 0.33. Photo taken in Huntington Botanical Gardens, San Marino, California. LEFT to RIGHT: W. Taylor Marshall, William Hertrich, Curator of the Gardens, and Dr. R. W. Poindexter.

Genus 24. *Echinocactus*. (Pl. 16: Fig. 25.)

The genus as established by Link and Otto has had referred to it about 1025 names from 138 genera. The genus as defined by Britton and Rose, and here considered, is restricted to very large, thick, globose to cylinder-shaped, many-ribbed plants, the top of the plant usually clothed with a dense mass of wool. They most nearly resemble *Ferocactus* from which they can be easily distinguished by the densely woolly fruits,

while those of *Ferocactus* bear no wool. Plants sometimes weigh hundreds of pounds. Britton and Rose refer here 9 species but this number can be greatly reduced when based on further study.

Echinocactus polycephalus Engelm. & Big., 1856, is so close to *E. xeranthemoides* (Coulter) Engelm., which was first described as *E. polycephalus* var. *xeranthemoides*, that the latter trinomial should be retained. In appearance and

habit, the plants are identical but the seeds of *E. polycephalus* are said to be papillose while those of the variety are said to be smooth. We feel that convenience would best be served by uniting them under one name.

E. ingens Zucc., *E. grandis* Rose, *E. platyacanthus* Link & Otto, *E. Palmeri* Rose, and *E. visnaga* Hooker, are forms of the same plant and under like conditions of climate and soil are indistinguishable. This is proven by the many plants of the various species assembled in the Huntington Botanical Garden at San Marino, California, of which only *E. visnaga* Hooker, differs in its longer fruit. Seedlings grown from collected seeds of any of those species contain all of the forms supposed to be characteristic of any one of them. They show 5 to 15 or 20 ribs and few to many spines which may be long or short, weak to strong. One constant character only is observed in all of the seedlings from any one of the species and that is the purple transverse markings that make them outstandingly attractive at this stage.

Since *E. platyacanthus* Link & Otto has precedence because of earliest publication (1827) and

also because this is the type species of the genus, all of the above species are here referred, with the exception of *E. visnaga*, with its longer fruit which we consider as *E. platyacanthus* Link & Otto var. *visnaga* Hooker.

The genus therefore has four known species:

E. Grusonii Hild.

E. platyacanthus Link & Otto.

var. *visnaga* Hooker.

E. polycephalus Engel. & Big.

var. *xeranthemoides*

E. horizonthalonius Lem.

Habitat: United States and Mexico.

Culture: As for *Ferocactus*.

Desirability: Seedlings are interesting balls of spines, but mature plants take lots of room, have rather small flowers and are hard to grow.

Uses: The pulp is used in the manufacture of cactus candy.

Desirable species: *Echinocactus Grusonii* Hild., called the Golden Ball, heads the list but the dark green body with purplish stripes make *E. platyacanthus* Link & Otto very popular. *E. horizonthalonius* Lem. of Texas and Arizona is perhaps most often seen in collections.

Genus 25. *Homalocephala* Br. & R., 1922. (Pl. 16: Fig. 26.)

A genus whose one species, *Homalocephala texensis*, was separated from *Echinocactus* because of its purple flower, juicier fruit, which occasionally bursts irregularly, and its different seeds. It is very probable, however, that this genus will be returned to *Echinopsis* in the near future as the differences are too unimpor-

tant to justify its retention.

H. texensis is a very flat, disc-like plant from Texas, New Mexico, and northern Mexico. It is interesting because of its shape but is rather difficult to grow. Very loose gravelly soil, with gypsum added, is recommended. Water should be supplied rather sparingly.

Genus 26. *Astrophytum* Lemaire, 1839.

Plants usually globe-shaped (Pl. 16: Fig. 27), rarely cylinder-shaped with few but very prominent ribs more or less covered with white scales, which make the plants appear as though powdered. Spines, in two species are long, but in the other two species are absent. The large yellow to reddish flowers arise near the center of the plants, followed by very woolly fruit.

Habitat: The four species are native to Mexico, but one extends into Texas.

Culture: Three species are fairly hardy, resisting light frosts, but *Astrophytum capricorne* and its many varieties are much less hardy. Loose

but rich soil with added calcium is recommended with liberal water in warm weather, if plants are well rooted.

Desirability: *Astrophytum myriostigma* Lem., commonly referred to as the Bishop's Cap cactus, is one of the most popular of all cacti. The other three species are equally attractive.

Desirable species: *Astrophytum myriostigma* Lem. in its several varieties, *A. ornatum* (D.C.) Weber *A. capricorne* (Dietr.) Br & R in several varieties, and *A. asterias* (Zucc.) Lem. which greatly resembles a sea-urchin, are all obtainable though some varieties are rare and con-

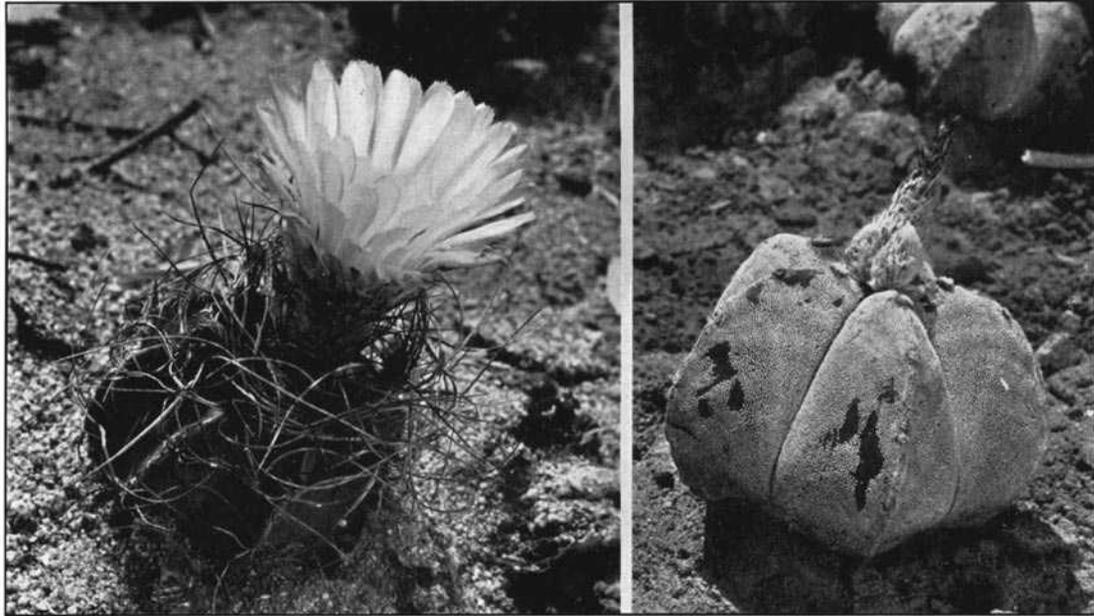


FIG. 108. LEFT: *Astrophytum capricorne* (Dietr.) Br. & R. x 0.33. FIG. 109. RIGHT: *Astrophytum myriostigma* Lemaire 0.33. Photographed by Graham Heid at Knickerbocker Nursery, San Diego, California.

sequently expensive. Seedlings do well and make the best looking plants. A number of hybrids are offered as seedlings and are very interesting.

The following key to varieties is based on one

prepared by A. Moeller and published in *Cact. & Succ. Journ. of Amer.*, Vol. 1: pg. 157, and should aid in identifying the variations in this genus:

Plants spiniferous:

Ribs prominent:

Spines contorted, robust. *A. capricorne*

Spines bristle-like:

Spines ashy-gray *A. capricorne* var. *senilis*

Spines in center of plant, yellow, later gray *A. capricorne* var. *aurea*

Spines straight, porrect:

Plant globose; spines dull *A. ornatum*

Plant cylindrical in age; spines yellow *A. ornatum* var. *Mirbelii*

Plants spineless:

Ribs rounded. *A. asterias*

Ribs prominent:

Flower with a red center. *A. myriostigma* var. *coahuilensis*

Flower all yellow:

Tall columnar plants *A. myriostigma* var. *columnaris*

Not tall columnar plants:

Plants always four ribbed. *A. myriostigma* var. *quadricostatus*

Plants mostly five ribbed:

Plants spotted with white *A. myriostigma vera*

Plants not white spotted:

Plants not depressed globose *A. myriostigma* var. *tamaulipensis*

Plants depressed globose:

Flowers small *A. myriostigma* var. *Potosina*

Flowers large *A. myriostigma* var. *nuda*

Genus 27. *Eriosyce* Philippi, 1872.

A genus of large, globe-shaped (Pl. 16: Fig. 28), to cylinder-shaped plants with numerous ribs which are very spiny, resembling the *Echinocacti* of North America. The bell-shaped flowers bear much wool on the ovaries and tubes and sometimes bristles.

Habitat: Chile and Argentina.

Culture: Seedlings like loose, fairly rich soil, and will take fair amounts of water in growing season, if kept warm.

Desirability: Even as seedlings they are attractive and will repay your interest.

Desirable species: *Eriosyce korethroides* (Werd.) Bckbg., is most easily obtained. *E. ceratistes* is in collections.

RECENT NEW SPECIES SINCE BR. & R.

Britton and Rose united *Echinocactus ceratistes* Otto, and *Echinocactus auratus* Pfeiff., although the species seem to differ in enough points to justify their retention as separate entities.

E. ceratistes (Otto) Br. & R., is synonymous with *E. Sandillon* Phil., offered in the trade.

E. Bruchii (Br. & R.) Bckbg., is described as *Lobivia Bruchii* in "The Cactaceae," Vol. II: pg. 50.

E. aurata (Pfeiff.) Bckbg., may be described as follows: Globose, very large, apex depressed and very spiny; ribs about 28, vertical, compressed; areoles distant, bearing dense wool of a pinkish-white to dirty

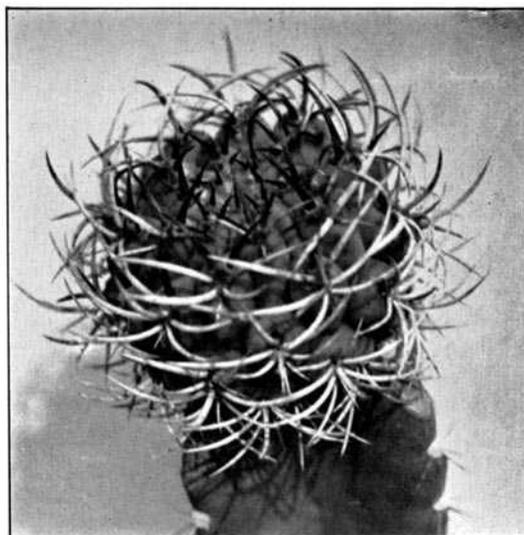


FIG. 110. A grafted plant of *Eriosyce ceratistes* (Otto) Br. & R. x 0.5

gray color; radial spines about 12, stiff, nearly straight, somewhat compressed, golden yellow, central spines 1 to 2, subulate; all spines up to an inch or more long.

E. korethroides (Werd.) Bckbg. Simple, globose, up to 12 inches in diameter, pale, glossy green; apex depressed: ribs 12 to 20 or more, narrow, spirally arranged; areoles large, oval, ½ inch or more apart; radial spines 12 to 20, whitish or yellowish, acicular, divergently spreading, mostly straight; up to an inch or more long; central spines 4 or more, yellowish-brown to reddish-brown, annulate, flattened; flowers pale red, nearly 3 inches long.

Genus 28. *Pyrrhocactus* Berger. (Pl. 17: Fig. 29.)

A genus of South American globular cacti with notched ribs and armed with heavy subulate spines; flowers reddish to yellowish; ovary bearing scales which subtend wool and sometimes bristles in their axils. The genus is closely allied to *Neoporteria* from which it differs principally in the more globose forms of the species and much heavier armament. The generic name means "Flame Cactus," referring to the flame-colored flowers of some species.

Five of the eight species referred here were included by Britton and Rose in their very complex genus *Malacocarpus*. One species was assigned to the genus *Friesia* (nomen nuda) by Fric. The remaining species are new. From *Malacocarpus* the following species are transferred:

Pyrrhocactus catamarcensis (Speg.) Bckbg. (formerly *Echinocactus catamarcensis* Speg., 1905, and *Malacocarpus catamarcensis* Br. & R.).

P. curvispinus (Bertero) Berg. (formerly *Cactus curvispinus* Bertero, 1829, *Echinocactus* Remy., 1847, *Echinocactus Froeblichianus* Schum., 1903, and *Malacocarpus curvispinus* Br. & R.).

P. tubersulcatus (Jacobi) Berger (formerly *Cactus horridus* Colla, 1833, (not *C. horridus* H.B.K., 1823), *Echinocactus horridus* Remy, 1847, *Echinocactus tubersulcatus* Jacobi, 1856, *Echinocactus Soehrensii* Schum., 1901, *Malacocarpus tubersulcatus* Br. & R., and *Pyrrhocactus horridus* Bckbg., 1935.)

P. mammillarioides (Hook.) Bckbg. (formerly *Echinocactus mammillarioides* Hooker, 1837, *E. hybo-centrus* Lehm., 1837, *E. centeterius* Lehm., 1837, *E. pachycentrus* Lehm., 1837, *Malacocarpus mammillarioides* Br. & R., and *Pyrrhocactus centeterius* Berg.)

P. Strausianus (Schum.) Berger (formerly *Echinocactus Strausianus* Schum., 1901, and *Malacocarpus Strausianus* Br. & R.).

Habitat: Argentina and Chile.

Culture: Slow growing as seedlings and do well when grafted on a strong stock. If grown on their own roots, a well drained, fairly rich

soil is most suitable with ample water in the growing season.

Desirability: Species flower freely and the strong and colorful spines make the plants attractive.

Desirable species: The few species offered by dealers are equally desirable.

RECENT NEW SPECIES SINCE BR. & R.

Pyrrhocactus bulbocalyx Werd., Argentina. Simple, sub-globose, gray-green, apex covered with incurved, rust-colored spines; ribs about 12; areoles distant, woolly and hairy when young, later naked; radial spines 7 to 11, spreading, about ½ inch long, gray; central spines 4, subulate, nearly an inch long, gray

with black tips, incurved, base swollen; flowers nearly 2 inches long, straw-colored.

P. dubius Bckbg., 1935. Cylindrical to 1 inch high; ribs 13; areoles oval, with yellow felt; radial spines 10 to 12, about ½ inch long, horn-colored to brownish; central spines 1 to 2, up to 1 inch long; flowers small, green-yellow.

P. umadeave (Fric) Werd. & Bckbg. (formerly *Friesia umadeave* Fric, 1930, and *Echinocactus umadeave* Werd., 1931. Simple or cespitose, globular to cylindrical, dull green, to 16 inches high and 10 inches in diameter; ribs 18 to 27, somewhat tuberculate; areoles large with white felt; spines 30 to 35, radials and centrals alike, subulate, white to light brownish-pink with darker tips, an inch to 1½ inches long, all curved upwards; flowers from center of plant, yellow.

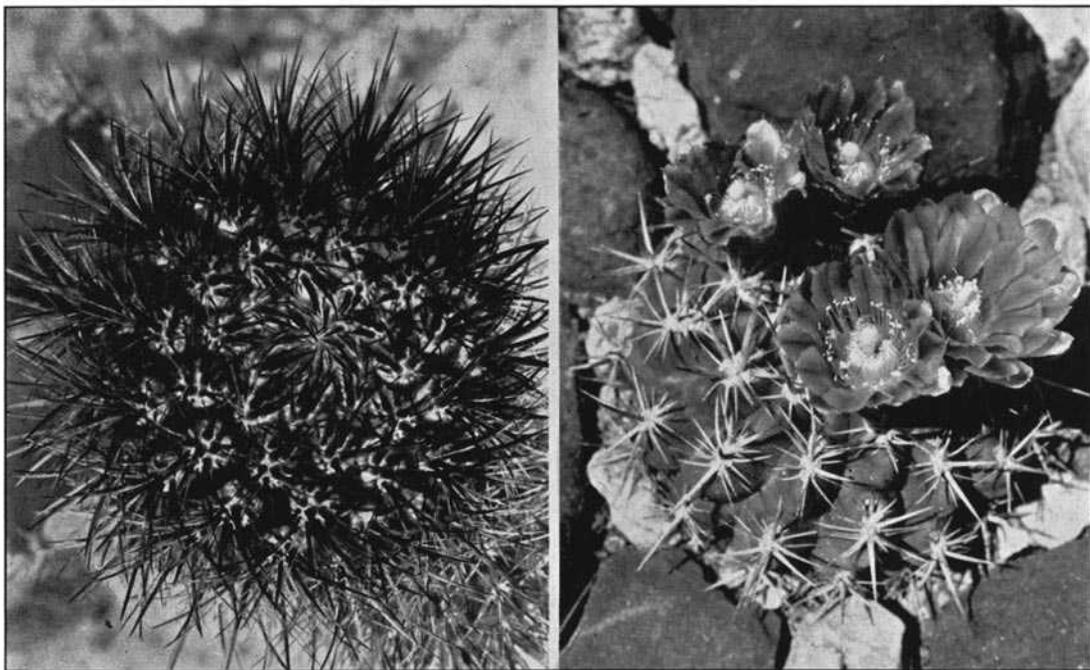


FIG. 111. LEFT: *Neoporteria subgibbosa* (Haw.) Br. & R. x 0.5. A black-spined variety which is offered in the trade as *Pyrrhocactus nigrihorridus*. The plant flowered on November 20, 1941, and bore two flowers at each of twenty areoles. FIG. 112. RIGHT: *Pyrrhocactus tuberisulcatus* (Jac.) Berger x 0.5.

Photo by R. H. Lahmeyer, Fort Wayne, Indiana.

Genus 29. *Malacocarpus* Salm-Dyck, 1850.

The generic name, *Malacocarpus*, is from two Greek words meaning "soft" and "fruit." This genus consists of flat or flattened-globe shaped (Pl. 17: Fig. 30), ribbed, small plants producing a mass of wool in the crown, from which the small but numerous flowers are produced, and from which the red, juicy, berry-like fruit is projected after it has ripened. Ten species are listed.

To this genus Britton and Rose, through lack of first-hand knowledge, assigned many quite different plants now referred to the genus *Notocactus* and elsewhere.

The species listed by Britton and Rose as *Malacocarpus* and which are still retained in this genus are:

Malacocarpus Sellowii (Link and Otto) Schum.,

listed as *M. tephraacanthus*.

Malacocarpus erinaceus (Haw.) Rümpler.

Malacocarpus Langsdorfii (Lem.) Br. & R.

Habitat: Uruguay to Paraguay and southern Colombia.

Culture: Seedlings are fairly hardy and do equally well out of doors in temperate climates, or in a greenhouse. Soil should be loose but rich and water can be liberally supplied in warm weather. Because of their small size they are ideal for pot-grown collections.

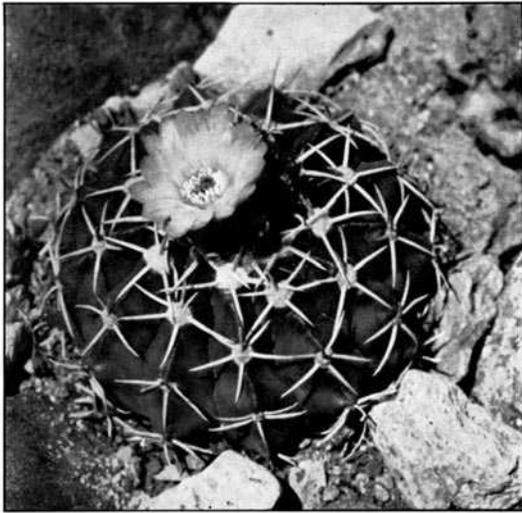


FIG. 113. *Malacocarpus Sellowii* (Link & Otto) Schum. x 0.5. Photo by R. H. Lahmeyer, Fort Wayne, Indiana.

Desirable species: *Malacocarpus Sellowii* (Link & Otto) Schum., and *M. Arechavaletai* Berger are available but rare.

RECENT NEW SPECIES SINCE BR. & R.

Malacocarpus Sellowii (Link & Otto) Schum., was listed in "The Cactaceae," Vol. III: pg. 188, as *M. tephraacanthus*. *Echinocactus tephraacanthus* was published by Link & Otto in the "Gartenbuch" in 1827 and *Echinocactus Sellowii* was published by them also in the same book so that there can be no precedence between the two names, and that name which has been in continuous use, namely *E. Sellowii*, is to be accepted. The species is deep green, has 16 to 18 ribs and 5 to 7 radial spines, but no central spines—and the flower is canary yellow. The following varieties are listed:

Var. *Couranti* Gürke (*Echinocactus Curanti* Gürke) has more ribs (19 to 21), one central spine, flower larger, bright yellow.

Var. *macracanthus* Arech. (*Echinocactus macracanthus* Arech.) . Pale green; ribs 12 to 14; radial spines stronger and longer; one central spine; flowers large, pale yellow.

Var. *tetracanthus* Lem. (*Echinocactus tetracanthus* Lem.). Dark green; ribs 21 to 26; radial spines 4, crosswise, short; flowers smaller.

Var. *Martini* Schum. (*Echinocactus Martini* Cels). Gray-green, small; ribs 12; radial spines 4 or 5; no central spine.

Var. *turbinatus* Arech. Dark green; ribs 12 to 20; radial spines 5 to 10; central spine one.

M. corynoides Salm-Dyck. (Erroneously included in the synonymy of *M. erinaceus* by Britton and Rose), south Brazil, Uruguay and Argentina. Globose to cylindrical, up to 8 inches high and 4 inches in diameter, dark green, woolly at the apex; ribs 13 to 16, acute, thickened at the areoles; areoles about ½ inch apart, round, at first with white wool; radial spines 7 to 12, awl-shaped, yellow; the lower ones up to 1 inch long; central spine 1 or none; flower 2 inches wide, canary yellow; fruit oblong, dark red.

M. Arechavaletai Berger, 1905, Uruguay. Globose, dark green, woolly at apex; ribs 16 to 18, low and rounded; areoles closely set, bearing white wool when young; radial spines 9, white to blackish; central spines 2 or 3, but usually 1, nearly an inch long; flower 2 inches broad, golden yellow.

M. Fricii Arech., 1905, Uruguay. Depressed-globose, 2½ inches in diameter, glossy pale green; ribs 20, acute, wavy; areoles round, bearing white wool, about 4 on each rib; spines 6 or 7, all alike, curved, flexible, brown; flower yellow.

M. Kovarici Fric, 1924, Uruguay. Resembles *M. corynoides* and is possibly a variation of that species.

M. leucocarpus Arech., 1905, Uruguay. In body structure this species resembles *M. corynoides* but the stem is bluish-gray in color, the flower has many more petals and the fruit is white.

M. pauciareolatus (Arech.) Berger, 1905, Uruguay. Differs from the other species mentioned above principally in having but 2 areoles to a rib and only 4 spines. The only illustration of the species available, however, shows a plant with three to four areoles to a rib and six to seven spines to an areole. This illustration appears in Backeberg's Bulletin of Cactus Research and if it can be accepted as authentic there seems to be no justification for separation from *M. corynoides*.

M. Vorwerkianus (Werd.) Bckbg., 1931, Colombia. Disk-like, 2 inches high and 4 inches in diameter, bright green, apex white woolly; ribs about 20, wavy, widened at the areoles; areoles not closely set, round; spines 5 to 6, yellowish-white with darker tips; flowers about 1 inch wide, pale yellow; fruit deep pink.

Genus 30. *Notocactus* Schumann, 1898.

Globe-shaped or cylinder-shaped, rather small plants with numerous ribs and usually densely

spiny (Pl. 17: Fig. 31). The large showy flowers are yellow, red or greenish and the flower-tube



FIG. 114. LEFT: *Notocactus mammulosus* (Lem.) Berger var. *pampeanus* x 0.5. Photo by R. H. Lahmeyer, Fort Wayne, Indiana. Fig. 115. RIGHT: *Notocactus apricus* (Arech.) Berger x 0.5. Photograph of a grafted plant in R. W. Poindexter's Nursery, Compton, California.

is covered with scales which have bristles in their axils. The fruit is bristly and dry. About 20 species are known.

Britton and Rose included most of the species now found in *Notocactus* in their genus *Malacocarpus* but plants in this latter genus have soft, naked, red fruits resembling those of *Melocactus* or *Mammillaria* while the species referred here have dry, woolly fruits. Lack of living material for study was doubtless the cause of this obvious error. We follow all recent writers in placing the following species in *Notocactus* because of the fruit characteristics.

From the genus *Malacocarpus*, as outlined by Britton and Rose ("The Cactaceae," Vol. III: pgs. 187 to 205), the following species are referred here:

- Notocactus Schumannianus* (Nicolai) Berg.
- Notocactus Grossei* (Schum.) Berger.
- Notocactus Schumannianus* var. *nigrispinus* Schum. (*Malacocarpus nigrispinus* [Schum.] Br. & R.).
- Notocactus apricus* (Arech.) Berg.
- Notocactus concinnus* (Monv.) Berg.
- Notocactus tabularis* (Cels) Berg.
- Notocactus scopia* (Sprengel) Berg., and its varieties *candida* and *ruberrima*.

Notocactus Patagonicus (Weber) comb. nov. (*Austrocactus patagonicus* Bckbg. *Austrocactus intertextus* Speg.).

Notocactus muricatus (Otto) Berg.

Notocactus Ottonis (Link & Otto) Berg., and its many varieties.

Notocactus mammulosus (Lem.) Berg.

Notocactus Haselbergii (Haage, Jr.) Berg.

Notocactus Leninghausii (Haage Jr.) Berg.

Notocactus Graessneri (Schum.) Berg.

The names *N. floricomus*, *N. pampeanus*, and *N. submammulosus* apply to varieties of *N. mammulosus*. *N. tabularis* is referable to *N. concinnus*.

Habitat: From north Argentina and Paraguay to southern Brazil.

Culture: Most species are quite frost resistant and have withstood temperatures as low as 20°. Loose, rich soil and liberal water produce best results. They are frequently grafted and do well.

Desirability: Among the most desirable of the smaller cacti because of the bright coloring of the bristle-like spines that cover the plants and the relatively large, showy flowers freely produced. Pot-grown plants are in flower several months out of the year.

Desirable species: Notocactus Leninghausii with its golden spines; *N. scopa*, spines pure white; *N. scopa* var. *ruberrima*, spines white with red intermixed; and *N. Schumannianus*, copper-colored spines, are all obtainable. Every species known is desirable.

RECENT NEW SPECIES SINCE BR. & R.

Notocactus Mueller-Melchersii Fric, 1928, differs from *N. apricus* only in its slightly whiter radial spines and in having 1 in place of 4 central spines. It should be classed as a variation of *N. apricus*.

N. rubriflorus (Kolischer, 1934?), is described as having 21 ribs, about 20 yellow radial spines and 4 reddish central spines. The flower is reported as red, which is an unusual color in this genus. No material is available for study and the plant is doubtfully referred here pending first hand information.

N. Bertinii (Cels) comb. nov. (*Cereus Dusenii* Weber *Austrocactus Bertinii* Br. & R.) Dr. Hosseus, in „Notas Sobre Cactaceas Argentinas,” calls attention to the fact that the characteristics on which the genus *Austrocactus* was erected, viz., hooked spines and red stigma lobes, is found in *Notocactus patagonicus* and other species referred to *Malacocarpus* by Britton and Rose. Therefore, there is no justification for the genus *Austrocactus*, and he has returned the species of *Austrocactus* to Britton and Rose's *Malaco-*

carpus. However, as the fruits of these species are dry and both woolly and spiny, we refer them to *Notocactus* as that genus is here considered.



FIG. 116. *Notocactus Ottonis* (Lem.) Berger x 0.5. Photo by Graham Heid.

Genus 31. *Parodia* Spegazzini, 1923.

Britton and Rose first recognized the necessity for the erection of a separate genus for the one species they then knew, and proposed the generic name *Hickenia* for it. Spegazzini, in 1923, called attention to the prior use of *Hickenia* in the family ASCLEPIADACEAE by Lillo in 1919 and proposed *Parodia* as the generic name for these species in honor of Dr. Domingo Parodi, one of the first investigators of the flora of Paraguay.

As now outlined, the genus contains about twenty-one species of plants with rather diverse factors. For example, in some species (*P. Maassii*, *P. aureicentra*, *P. Schwebsiana*, etc.), the fruits remain in the freely produced wool in the top of the plant, like *Malacocarpus*. In others, the fruits bear the floral remains and are visible, as in *Notocactus*. Some have hooked central spines (Pl. 17: Fig. 32), while in other species the spines are all straight. The plants are small, and the flower tubes are very hairy and bristly

and the fruits are smaller than in *Malacocarpus* or *Notocactus*.

Habitat: Northern Argentina and central Bolivia, across Paraguay, to southern Brazil.

Culture: Many species have proved hardy to 20°. Loose but rich soil and liberal water in warm weather has produced excellent results. Plants of this genus do very well if grafted.

Desirability: The colorful flowers, freely produced, and the small size of the plants which permits a large collection in a limited space, make them very attractive to fanciers and they are ideal for potting. Easily grown from seed.

Desirable species: Parodia Maassii (Heese) Berg., *P. aureicentra* Bckbg., *P. chrysacanthion* (Schum.) Bckbg., *P. microsperma* (Web.) Speg., *P. islayensis* (Forster) Borg, and *P. minor* (Bckbg.) Borg, are all desirable and obtainable, but all of the known species are worthwhile.

RECENT NEW SPECIES SINCE BR. & R.

Only *Parodia microsperma* was described by Britton and Rose under the name of *Hickenia microsperma*, therefore all of the other species are new as *Parodias*. *P. islayensis*, and its smaller counterpart *P. minor*, were described under the generic name *Islaya* by Backeberg. *P. islayensis* is a former *Malacocarpus* species of Britton and Rose and is described by them as such, ("The Cactaceae," Vol. III: pg. 201). Both *P. islayensis* and *P. minor* are straight-spined species.

P. aureicentra Bckbg., 1935, Argentina. Possibly only a variety of *P. Maassii* but with about 40 hair-like radial spines and one long, hooked central spine; flowers blood-red.

P. aureispina Bckbg., 1934, Argentina. Light bluish-green; ribs spiralled, tuberculate; about 40 fine, white radial spines; central spines about 6, golden, one hooked; flowers from the brown-woolly crown, over an inch in diameter, golden.

P. brasiliensis Speg., 1925, Brazil. Globose, grass-green; ribs about 15, tuberculate; areoles small with short brown wool; radial spines 8 to 10, bristle-like, white to yellowish; central spine 1, curved backwards, brown, its tip hooked backward; flowers whitish to pale pink.

P. carminata Bckbg., 1935, Argentina. Oval, dull bluish-green; ribs spiralled; radial spines about 18, fine, white; central spines about 4, dark to blackish-brown, the lowest one hooked; flowers one inch long and wide, carmine. Very near to *P. Stuemeri*.

P. erythrantha Speg., 1905, Argentina. Globose, leaf-green; ribs formed of small tubercles in spiral arrangement; areoles approximate, at first with white wool; radial spines about 20, very fine, short, matted; central spines 4, white at base, reddish above, thin, one hooked; flowers small, pure red.

P. Faustiana Bckbg., 1935, Argentina. Globose, pale grass-green; ribs tuberculate, spiralled; radial spines about 20, bristly, glassy white, interlaced; central spines 4, stronger, brown, an inch long, straight; flowers scarlet outside, golden within.

P. Maassii (Heese) Berg., was described in "The Cactaceae," Vol. III: pg. 202. *P. chrysacanthion* (Schum.) Bckbg., was described as *Echinocactus chrysacanthion* in "The Cactaceae," Vol. III: pg. 176, and *Echinocactus escayachensis* Vaupel and *Malacocarpus* sp., both described in "The Cactaceae," Vol. III: pg. 205, are *Parodias*.

P. Microthele Bckbg., 1935, Argentina. Globose, pure green, with spirally arranged confluent tubercles; spines very fine, bristle-like, short, white, with fine yellow to brownish bristles between them, straight; flowers medium sized, orange.

P. mutabilis Bckbg., 1934, Argentina. Globose, blue-green; radial spines about 50, pure white, bristly; central spines 4, white to orange with darker tips, one hooked; flowers 2 inches in diameter, golden, sometimes with a red throat.

P. nivosa (Fric) Bckbg. (*Microsperma nivosa* Fric). Simple, slightly cylindrical, dull green; ribs of spirally

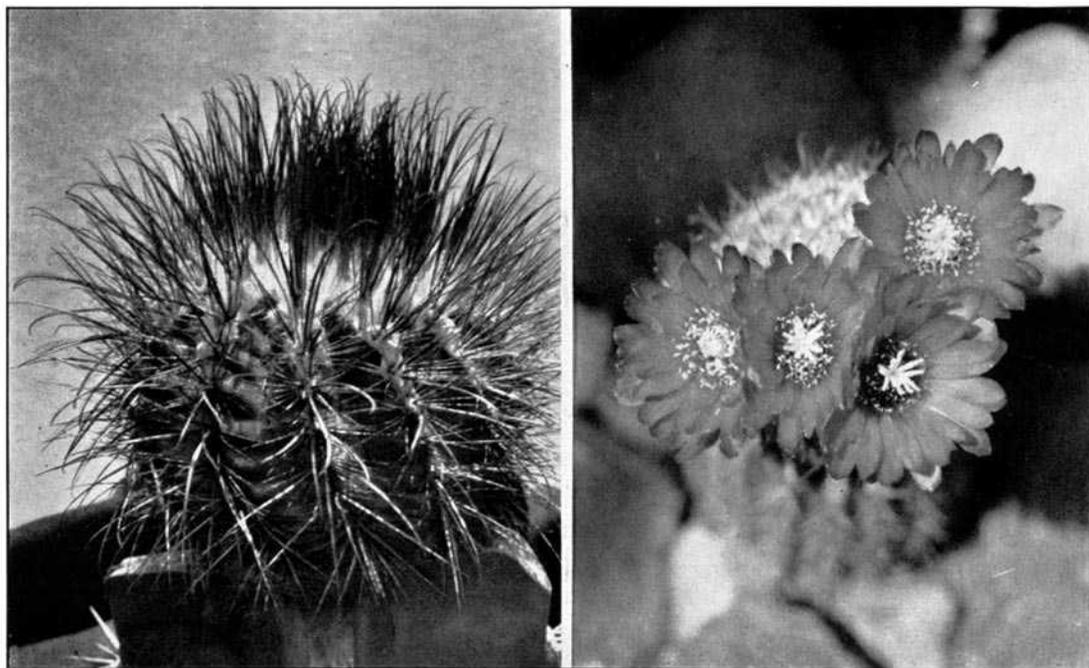


FIG. 117. LEFT: *Parodia aureispina* Bckbg. x 0.5. Grafted plant photographed by Scott Haselton. FIG. 118. RIGHT: *Parodia sanguiniflora* Bckbg. x 0.5. Photo by R. H. Lahmeyer, Fort Wayne, Indiana.

arranged, conical tubercles; areoles at first with white wool; radial spines about 18; glassy, thin; central spines 4, the lowest up to nearly an inch long, straight; all spines pure white; flowers bright blood-red.

P. paraguayensis Speg., 1923, Paraguay. (*Echinocactus amambayensis* Werd.). Simple or clustered, globose, grayish-brown; ribs 8 to 12; areoles slightly woolly when young; radial spines 5, curved backward; central spine 1, hooked at tip; all spines at first ash-gray passing to horn-color; flowers golden.

P. rubricentra Bckbg., 1935, Argentina. Closely allied to *P. Stuemeri* and *P. carminata* but with white spines and pale coppery-orange flower.

P. sanagasta (Fric) Weing., 1935, Argentina. Globose, often coppery-red; ribs about 15, tuberculate; areoles at first bearing much felt; radial spines 7 to 11; central spines 4, ruby red, the lowest hooked, in age becoming white; flowers yellow, the outer petals with a brown stripe on the back.

P. sanguiniflora (Fric) Bckbg., 1934. (*Microspermia sanguiniflora* Fric). Slightly cylindrical, fresh green ribs of spirally arranged conical tubercles; areoles at first with much white wool; radial spines about 15, fine, white; central spines 4, brown, the lowest hooked; flowers blood-red.

P. Schwebsiana (Werd.) Bckbg., 1930, Bolivia. Somewhat columnar, shiny green; areoles at first with much white wool; radial spines about 10, horn-colored, curved; central spine 1, curved or hooked, horn-colored; flowers carmine.

P. Schwebsiana var. *salmonea* Bckbg. Flowers pale salmon.

P. scopoides Bckbg., 1935, Argentina. Globose, dark green; ribs of spiralled tubercles; areoles at first densely white woolly; radial spines bristly, glassy white; central spines 4, robust, red, hooked; flowers orange.

P. setifer Bckbg., 1934, Argentina. Depressed globose, dark green; ribs about 18; areoles elongated, with little wool; radial spines about 29, pure white; central spines 3 or 4, flesh-colored to black, one hooked; flowers whitish-yellow.

P. Stuemeri (Werd.) Bckbg., 1931, Argentina. Spherical; ribs about 20, indistinctly tuberculate; areoles very woolly at first; radial spines about 25, acicular, white, matted; central spines 4, the lowest curved, reddish or violet brown, up to more than an inch long; flowers golden below, coppery orange above.

Var. *tilcarensis* Werd. & Bckbg. (*Parodia tilcarensis* Bckbg.). Spines fewer, flowers clear orange-red.

Genus 32. *Frailea* Br. & R., 1922.

A genus of very small plants (Pl. 17: Fig. 33), globe-shaped or cylinder-shaped and usually offsetting freely. The small flowers do not usually open but occasionally a plant will be found whose flowers will open in full sun, especially *Frailea pulcherrima* (Lem.) Br. & R. Thirteen species are known.

Habitat: From Uruguay across Paraguay to southern Colombia.

Culture: As for *Parodia*. Most successful when grafted.

Desirability: Notable only for the number of offsets produced.

Desirable species: *Frailea grabliana* (Haage Jr.) Br. & R., *F. pygmaea* (Speg.) Br. & R., and *F. pumila* (Lem.) Br. & R., are available.

RECENT NEW SPECIES SINCE BR. & R.

Frailea asterioides Werd., 1937. Differing in all respects except flowers from the other *Fraileas*, this plant closely resembles *Astrophytum asterias* for which it would certainly be mistaken when not in flower. From southern Brazil.

F. aurea Bckbg., 1935, Uruguay. Globose, about an inch in diameter; areoles rounded, with brown wool; spines all radial, about 14, pectinate, yellow; flower yellow.

F. castanea Bckbg., 1935, Uruguay. Depressed globose, less than an inch in diameter; ribs 15, areoles small, bearing gray wool; radial spines 8, at first reddish, later black, the tips horn-colored; central spine 1, flower unknown; fruit globose, red.

F. colombiana (Werd.) Bckbg., 1931, Colombia. Depressed, nearly 2 inches in diameter, gray-green; ribs 16; spines 18 to 25, golden; flower yellow.

F. Dadakii (Fric) Br. & R. Similar to *F. pygmaea* but with 12 ribs; spines 8, brownish, later white, curved backward and twisted.

Genus 33. *Mila* Br. & R., 1922.

The name is an anagram of Lima, near which Peruvian city the three known species are found. The usually cylinder-shaped plants (Pl. 18: Fig. 34), grow in small clusters and the stems are hidden by the spines. The yellow, wheel-shaped flowers arise near the center of the top of the plant. The fruit resembles a gooseberry.

Habitat: Peru, near Lima.

Culture: When available, they should be grafted.

RECENT NEW SPECIES SINCE BR. & R.

In addition to the one species *M. caespitosa* on which Britton and Rose founded the genus ("The Cactaceae," Vol. III: pg. 211), the following species have been described:

Mila Kubeana Werd. & Bckbg., 1931, Peru. Cespitose, often semi-prostrate; ribs 11; areoles approximate, bearing yellow felt; radial spines 9 to 12, white, spreading, bristly; central spines 2 to 4, stronger, yellowish, later gray; flowers yellow.

M. Nealeana Bckbg., 1934, Peru. Cespitose; ribs 11, low, flat; areoles close together, bearing yellow wool; radial spines about 12, bristly, glassy; central spines 3 to 4, bristly, one turned downward, straw-colored; flowers pale yellow.

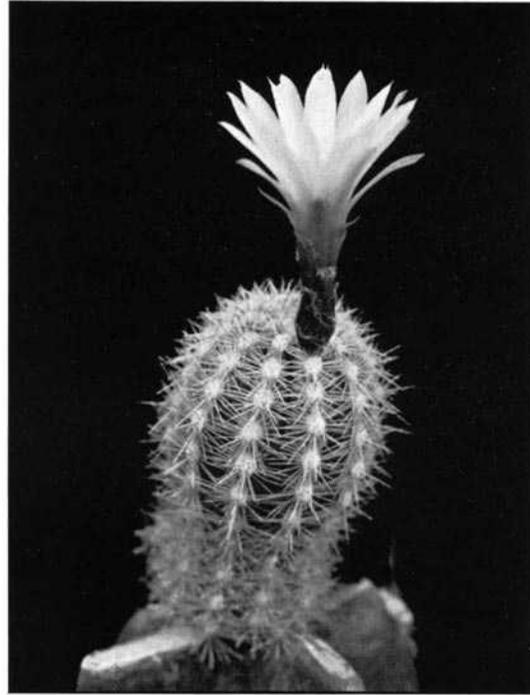


FIG. 119. Grafted plant of *Mila Kubeana* Werd. & Bckbg. x 1. Photo by Scott Haselton.

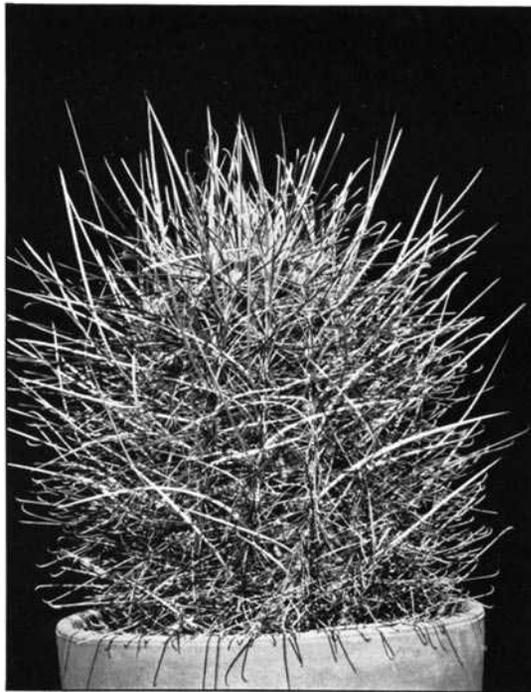
Genus 34. *Sclerocactus* Br. & R., 1922.

FIG. 120. *Sclerocactus polyancistrus* x 0.4. Photo by Graham Heid.

A genus of several species, the name derived from a Greek word meaning -hard, cruel, obstinate,- referring to the formidable central spines (Pl. 18: Fig. 35), which are strongly), hooked. The plants are cylinder-shaped, ribbed, but usually completely hidden by the mass of spines. The large, rather bell-shaped, purple flowers arise from the top of the plant. The fruit resembles that of a *Ferocactus*.

Habitat: California, Arizona, Utah, and Colorado.

Culture: Like many other desert species, this genus is very difficult to grow in cultivation. Perhaps a gravelly soil, well-drained, with added gypsum is best, and water should be given very sparingly. Grafting is also difficult, but if successful is the best method of keeping the plants alive.

Desirability: The plants are showy and the flowers large and striking.

Desirable species: *Sclerocactus polyancistrus* has spines of three colors, white, red, and purple and is the most attractive; *S. Whipplei* lacks the coloring in the spines.

RECENT NEW SPECIES SINCE BR. & R.

Sclerocactus Franklinii Evans in Cact. & Succ. Journ. of Amer. is, in my opinion, a form of *S. Whipplei* and could be considered as a variety of that species.

S. parviflorus Clover & Jotter, 1941, Canyon of the Colorado, Arizona. Simple, oblong, to 18 inches tall; ribs 13, strongly tuberculate; radial spines 14 to 15, white with dark tips, flattened, heavier and longer in

the lower part of the areole, there up to 1½ inches; central spines 4, the upper 3 angled, flexible, ascending, the uppermost white to horn-colored, the lower centrals ribbed, deflexed, up to 3 inches long, all centrals except uppermost reddish, curved or hooked; flowers purple, 1 inch long and not so broad; perianth segments broad with erose margins; style and the 10 stigma lobes purple, anthers yellow.

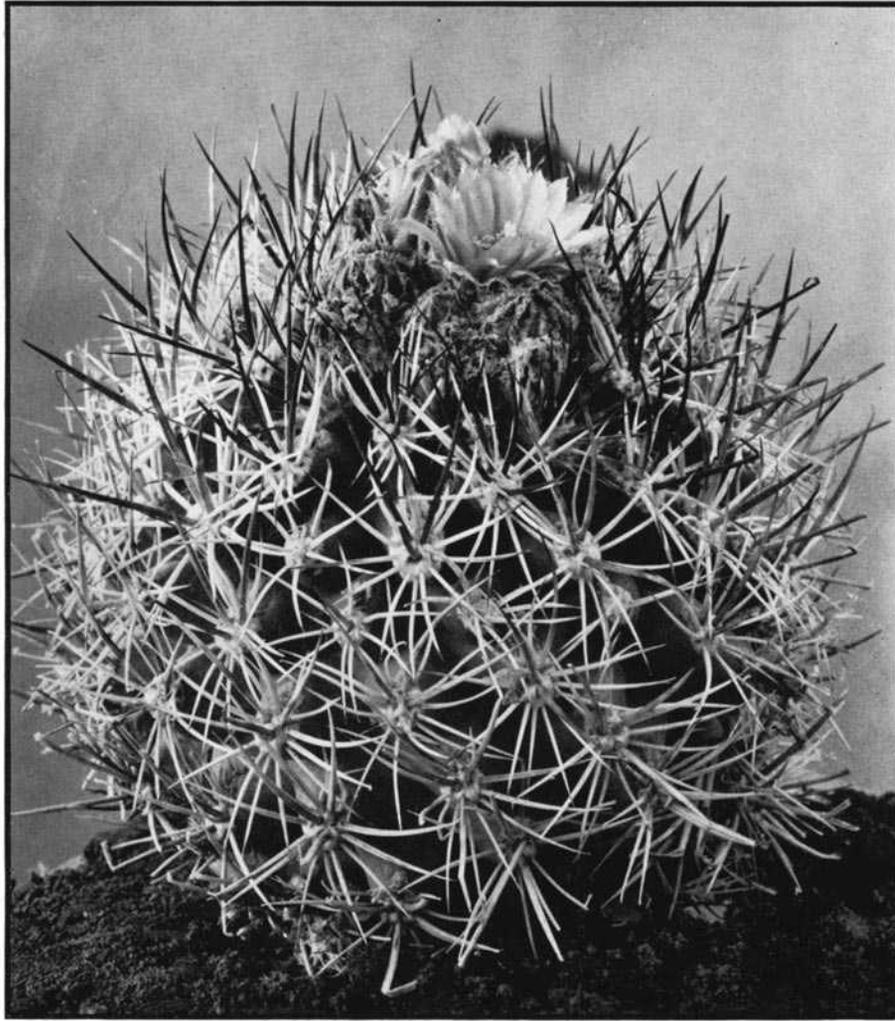


FIG. 121. *Utahia Sileri* (Engel.) Br. & R. x 1. Photo by R. H. Peebles.

Genus 35. *Utahia* Br. & R., 1922.

A genus of one species, *Utahia Sileri* (Pl. 18: Fig. 36). It is rare in collections and very difficult to grow unless grafted. In its home it is

found only in a white gypsum soil on well drained alluvial fans in Northern Arizona and perhaps in adjacent Utah.



FIG. 122. *Neogomesia agavioides* Castañeda x 1. from Cact. & Succ. Journ. of Amer., Vol. XIII: pg. 98.

Genus 36. *Neogomesia* Castañeda genus nova.

We publish herewith a remarkable new genus discovered by Engineer M. Castaneda while investigating the Cactaceae of the State of Tamaulipas, Mexico. This little plant has escaped observation because of its small size. Many characteristics set it off from known genera and its small mimicry form and attractive flowers will make it interesting to collectors. It should be grown the same as *Ariocarpus*.

NEOGOMESIA genus nova, Castaneda

Planta simplex humilis apice plana, radicibus carnosissimis fusiformibus. Tubercula rosulata cartilaginea folia *Agavei* simulant. Areolae magnae dense tomentosae in superficiem tuberculorum feruntur. Flores infundibulo-campanulati in partibus inferioribus tuberculum nascentium feruntur, tubis florum longis nudis, sepala pauca colorata ferunt. Fructus baccatus clavatus ruber.

Plant simple, low, with flat top; rootstocks fusiform, fleshy; tubercles resembling the leaves of an *Agave*, cartilaginous, in rosette formation; areoles on the upper face of the tubercles, large and bearing dense, long wool; flowers funnel-form-campanulate, the long tube naked except for a few sepals, these colored and without content in their axils; flower and fruit arising from the lower part of the areoles of nascent tubercles; fruit a clavate, red berry without floral remains.

This genus is nearest to *Ariocarpus* from which it differs in its long-tubed flower and its clavate,

red fruit which is prominently in sight from the first.

In its long tubercles and long-tubed flower it is also reminiscent of the *Leuchtenbergia* which is reported from adjacent districts. Both *Neogomesia* and *Leuchtenbergia* have stems built up by the dried base of the withered tubercles which Hooker noted as "resembling the stems of some cycads." *Neogomesia's* naked tubed flowers and indehiscent fruits as well as the position of its flowers amply separate it from *Leuchtenbergia*. The genus is named in honor of Engineer Marte Gomez, Governor of the State of Tamaulipas, Mexico.

Neogomesia agavioides sp. nov. Castaneda

Planta simplex depressa 5-8 cm. lata cinereo-viridis, radice carnosa fusiforme; tubercula 5-10 cartilaginea rugosa 4 cm. longa base circa 6 mm. lata apice acuta vel mucronata recurvata super de basibus ad areolas plana vel leviter convexa de areolis ad apices concava subter convexa vel leviter carinata, tuberculis junioribus erectis finaliter horizontalibus; areolae retundatae 3-4 mm. diametro cinereo-lanatae in superficies circa 1 cm. deorsum apices tuberculorum ferunter; spinae aut nullae aut 1-3 sublatae adpressae 3-5 mm. longae albae vel alboluteae; flores rosacei diurni 4-5 cm. longi, tubis circa 2 cm. longis nudis; sepala pauca pallido-rosacea; petala exteriora linearia acuta integra circa 4 mm. lata 20 mm. longa, interiora acuminata 25 mm. longa expansa; stamina flava; stylus albus lobis stigmatibus quinque albis; fructus clavatus 20-25 mm. longus ruber, seminibus ignotis.

Plant simple, depressed, 5 to 8 cm. broad, grayish-green; rootstock fusiform, fleshy; the crown of the plant resembles a small *Agave* or *Haworthia* because of the cartilaginous, linear tubercles, these 40 mm. long and about 6 mm. wide at the base, semi-circular in cross section, acute or mucronate, imbricate, rugose, at first erect, later ascending, then horizontal, usually with the tips recurved, the under surface convex or slightly keeled, the upper surface flattened or somewhat convex from the base to the areole, but concave from the areole to the tip; areole on the upper surface, about 1 cm. from the tip, large, round and filled with a mass of long, gray wool; spines usually wanting but occasionally 1 to 3, white to horn-colored, subulate, appressed 3 to 5 mm. long; flowers in November and December: 1 or 2 to a plant, diurnal, opening in the morning and lasting but one day, pink, large, borne near the center of the plant at the lower part of areoles of nascent tubercles, 4 to 5 cm. long, funnel-form-campanulate, with a long tube (2 cm. or more in length), naked; sepals few, scale-like, colored; outer perianth segments linear, acute, entire, 20 X 4 mm., white with pink

center; inner perianth segments linear, acuminate, spreading, 25 mm. long, pink with a nearly white base; filaments and anthers yellow; style white, stigma lobes 5, white; fruit red, clavate, 20 to 25 mm. long, ripening rapidly; seeds not observed.

Distribution: State of Tamaulipas.

Type material has been deposited in the Dudley Herbarium of Stanford University.

This species (Pl. 18: Fig. 37), superficially resembles a small *Ariocarpus trigonus*, but the tubercles are much longer and narrower and the prominent areoles are set back from the apex. There are only 5 to 10 tubercles to each plant and the rosette arrangement of them suggests a small *Agave* or *Haworthia*. The long tubed flower and the prominent red fruit set this plant off sharply from any known species of *Ariocarpus*.

Acknowledgement is made to Dr. Ira Wiggins who prepared the Latin descriptions.

Genus 37. *Blossfeldia* Werdermann.

A genus of one species, *B. liliputana* (Pl. 18: Fig. 38), found by H. Blossfeld and O. Marschner in northern Argentina in 1936, and not again collected, so far as is known.

The tiny plants are flattened discs, single or clustered, and without spines or bristles. The maximum size noted was 1.6 cm. (3/5 of an inch) in diameter. The areoles are scattered over

the surface of the plant and are united in the center from which the whitish flowers arise.

Dr. Werdermann in his descriptions says that the material sent to him may represent an "aberrant type" and may not be again collected. If it is found, however, it should prove of great interest as the smallest and most defenseless cactus.

Sub-tribe 5. Cactanae

Genus 1. *Discocactus* Pfeiffer, 1837.

A group of flattened, disc-shaped plants (Pl. 19: Fig. 1), with ribs divided into large tubercles and usually heavily armed with spines. There are 7 species known. The flowers arise from a head of wool and bristles surmounting the center of the top of the plant and are large,

night-blooming, and white to pinkish in color. The fruit is a red or yellow berry. The genus *Discocactus* is reported as very difficult to cultivate and most material sent from Paraguay and Brazil to Europe, by the early collectors, has not survived.

Genus 2. *Melocactus* Link & Otto, 1827. (Pl. 19: Fig. 2.)

These plants have more synonyms than any other genus, and 224 names have been recorded under *Melocactus* and 282 under the genus *Cactus*. *Melocactus* is preferable to *Cactus* as a generic name to avoid confusion.

A genus of tropical, barrel-shaped plants, surmounted by a head of wool and bristles, sometimes attaining a height of 14 inches. The body of the plant closely resembles *Ferocactus*. The very small flowers and the red, berry-like fruit,

are pushed up through the cephalium of wool and bristles. Twenty-four species are known.

Habitat: Mexico, West Indies, Guatemala, Honduras, Colombia, Peru, Venezuela, Dutch Guiana, and Brazil.

Culture: The culture of these plants has been a failure for many cactus fanciers. A soil of two-thirds sand, and one-third leaf-mold is used and plants are kept dry except in warm weather when liberal water is given. Only small quantities of water are used until the plants are well rooted. They are exclusively glasshouse plants and very sensitive to cold. Seedlings of most of the species have been successfully grown and a few seedlings form a cephalium in the third year.

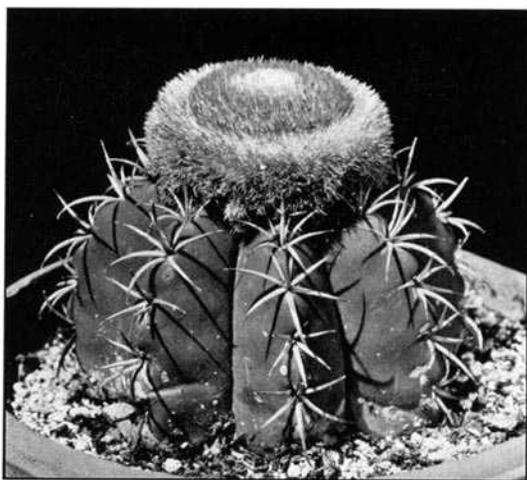


FIG. 123. *Melocactus matanzanus* Leon x 0.5. Photographed by Graham Heid in the author's collection.

Desirability: Plants of this genus attract more attention in collections than those of any other genus. Cephaliums usually appear only on very old plants and therefore seedlings are disappointing, with few exceptions, such as *M. matanzanus*, *M. caesius* and *M. Neryi*.

Uses: The fruits are eaten for their agreeable acid taste. They are highly prized as ornamentals in the tropics.

Desirable species: *Melocactus intortus* (Mil.) Urban, from Puerto Rico, is the most common. *M. Lemairei* (Monv.) Miguel, from Haiti, is perhaps easiest to grow but *M. communis* Link & Otto from Jamaica, *M. macracanthus* (Salm-Dyck) Link & Otto, from Curaçao, *M. caesius* Went., from Venezuela, and *M. Maxonii* (Rose) Gürke, do well and all are obtainable though rare.

RECENT NEW SPECIES SINCE BR. & R.

The Jamaican species of *Melocactus* listed by Britton and Rose as *Cactus melocactus* becomes *Melocactus communis* Link & Otto under international rules and common usage.

Cactus Townsendii was a new name by Britton and Rose for *Melocactus peruvianus* Vaupel, 1913, and the latter name has precedence.

Melocactus Ernestii Vaupel, 1920, is a synonym of *M. oreas*.

M. depressus is a synonym for *M. melocactoides* Hoff.

M. Acunai Leon, 1934, Cuba. Cylindrical to 12 inches high and nearly 4 inches in diameter; ribs 10, areoles closely set; radial spines 16, subulate, curved, clear gray becoming darker with age; central spines 3 or 4, up to 2 inches long; cephalium 3 inches high and about the same in diameter, composed of reddish bristles protruding from a mass of white wool; flowers an inch or more long, red. Associated with *M. Harlowii* but quite distinct from it.

M. Antonii Britton, Desecho and Mono Islands, West Indies. Similar to *M. intortus* and illustrated in "The Cactaceae," Vol. III: pg. 231, as that species, but the spines are more acicular and the flowers light pink. Convenience could best be served by considering this a variety of *M. intortus*.

M. Guitarti Leon, 1934, Cuba. Depressed globose, 4 inches high by 6 inches in diameter; ribs 12; areoles naked, remote; radial spines 9 to 10, rigid, spreading, yellowish, up to 1 inch long; central spines 2, about 1½ inches long; cephalium 3 inches in diameter and 1 inch high, composed of red bristles from a mass of white wool; flowers 1½ inch long, rose colored; petals about 22, oblong-linear; stamens numerous; style filiform; stigma lobes 5; fruit clavate, about 1½ inches long, seeds numerous.

M. Jansenianus Bckbg., 1935, Peru. Simple, globose, olive-green; ribs usually, very flat; radial spines about 8, blackish, horizontally spreading, nearly an inch long; central spine 1, porrect or curved upwards, dark brown to black, over an inch long; cephalium cylindrical, up to 6 inches high, reddish-brown; flowers small, red; fruits clavate, red.

M. macrodiscus Werd., 1932, Brazil. This plant has been described but has not been seen in cultivation so far as is known.

M. matanzanus Leon, 1934, Cuba. Globose or depressed globose, about 3 inches high, deep green, slightly pulverulent; ribs 8 or 9; areoles rather approximate, bear white wool in youth; radial spines 7 to 8, curved toward the ribs, spreading, reddish when young, later yellowish-white; central spine 1, subulate like the radials, ascending; cephalium about 3 inches in diameter and 2 inches high or less, composed of bright red bristles extending well beyond a mass of white wool; flowers small, rose-colored; petals about 22, mucronate, the outer ones rounded at the apex; filaments hair-like; anthers oblong; style filiform; stigmas 4 or 5, small; fruit small, clavate; seeds black.

M. violaceus Pfeiff., 1835, was considered as a synonym of *M. melocactoides* by Britton and Rose, but is considered as a good species by contemporary writers.

Sub-tribe 6. **Coryphanthanae**Genus 1. **Ancistrocactus** Br. & R., 1923.

The main characteristic of this genus is the bell-shaped flowers, on the sides or top of the plant (Pl. 20: Fig. 1), borne at areoles other than at spine-bearing ones. Otherwise the plants suggest the ECHINOCACTANAE in their cylinder or cone-shaped, ribbed stems; the ribs, however, are formed of tubercles or nipples. One central spine at each spine cluster is hooked, which explains the choice of the name Hooked Cactus, for the genus. The roots are fleshy or carrot-like. The oblong, juicy, thin-walled, greenish fruit bears a few broad scales on the upper part.

Three species are known.

Habitat: Texas and Mexico.

Culture: Loose gravelly soil, not too rich and with water supplied sparingly. Allow ample pot room for the large roots. Fairly hardy.

Desirability: The small greenish flowers, and the difficulty in growing, make *Ancistrocactus* less desirable.

Desirable species: *Ancistrocactus Scheeri* (Salm-Dyck Br. & R., and *A. breviamatus* (Engel.) Br. & R., are in plentiful supply, but *A. megarhizus* Rose, is rather rare.

Genus 2. **Neolloydia** Br. & R., 1922.

Like the foregoing genus, *Neolloydia* is closely allied to *Echinocactus* in its spiralled ribs (Pl. 20: Fig. 2), composed of tubercles. The large, pink to purple flowers arise from the axils of the tubercles. The fruit is compressed, globe-shaped, dull colored, thin-walled becoming dry and papery. Nine species are known.

Habitat: Texas and Mexico.

Culture: Similar to *Ancistrocactus*. Best grown from seed.

Desirability: Several species are very popular.

Desirable species: *Neolloydia Beguinii* (Weber) Br. & R., and its variety *senilis*, is very acceptable. *N. texensis* Br. & R., *N. ceratites* (Quehl.) Br. & R., *N. horripila* (Lem.) Br. & R., and *N. clavata* (Scheid.) Br. & R., are obtainable.

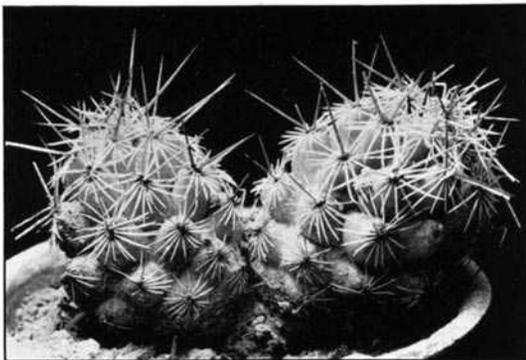


FIG. 124 *Neolloydia conoidea* (D.C.) Br. & R. x 0.33.
Photo by Oliver Young, Bridgton, Maine.

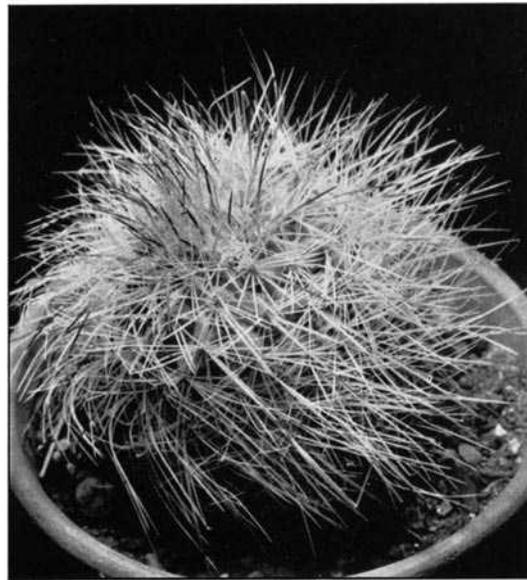


FIG. 125. *Neolloydia Beguinii* (Weber) Br. & R. var. *senilis*
x 0.5. Photo by Oliver Young, Bridgton, Maine.

RECENT NEW SPECIES SINCE BR. & R.

Neolloydia Beguinii (Weber) Br. & R. var. *senilis* Hort. Plant somewhat thicker than the species, with longer and whiter spines which completely hide the plant body; central spines 2 or 3, one of them porrect.

N. grandiflora (Otto) Berg. This species is sometimes considered as a mere variety of *N. conoidea* which it resembles. It has more abundant wool in the grooves of the tubercles and their axils, a few more radial spines, and larger flowers.

N. odorata (Boed.) Bckbg., 1930, (*Coryphantha odorata* Boed.). Forming clumps, the stems about an inch in diameter; tubercles cylindrical; radial spines 9,

white, brown or yellow, short; central spines 4, up to one inch long, dark brown to yellow, all hooked; flowers small, yellowish-pink.

Genus 3. *Thelocactus* (Schum.) Br. & R.. 1922

Thelocactus or "Nipple Cactus" is a genus of plants to which have been referred 21 species of cacti that intergrade between ECHINOCACTANAE and CORYPHANTHANAEE and is comprised of groups of unrelated plants that may constitute several genera when more completely known. Usually colorful, the large flowers borne on grooves on young tubercles near the center of

spine-bearing areoles. This genus differs from *Coryphantha* in its ribbed structure and dry fruits, but is nearly identical with the genus *Echinomastus*.

Habitat: Texas and Mexico.

Culture: All species require very well drained soil, but the globose species usually want more leaf-mold and more water than do the cylindrical ones.

Desirability: The large flowers and unique plant forms make this an attractive group of plants.

Desirable species: *Thelocactus nidulans* (Quehl.) Br. & R., is outstanding because of the

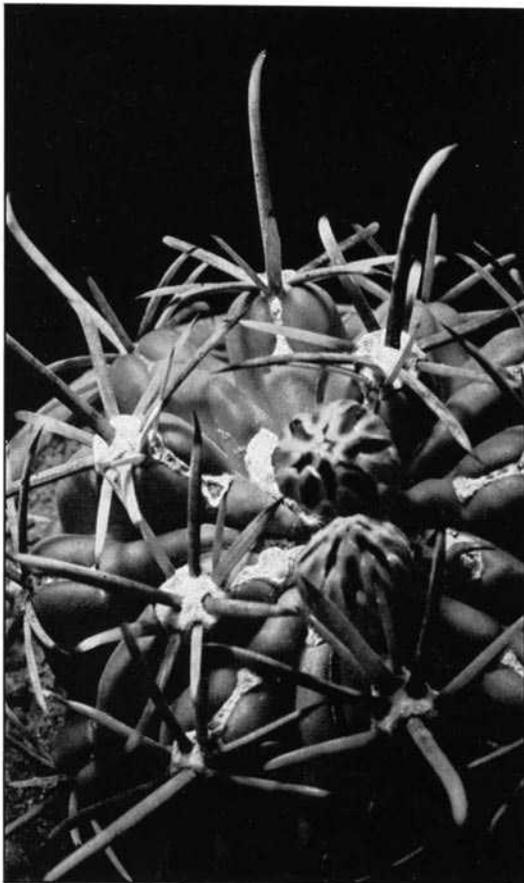


FIG. 126. *Thelocactus crassihamatus* (Weber) Marshall x 1. showing flowers arising from base of sulcations. Photo by Oliver Young, Brdgtton, Maine.

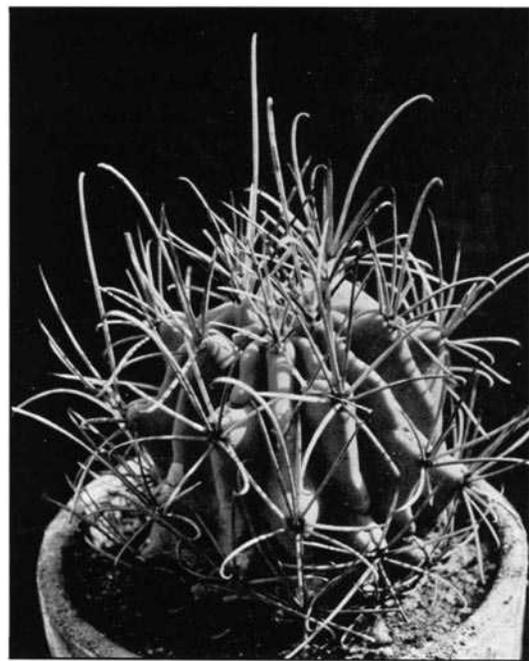


FIG. 127. *Thelocactus uncinatus* (Gal) Marshall x 0.4. Note sulcations from tip to base of indefinite tubercles. Photo by Oliver Young, Brdgtton, Maine.

the plant are the most noticeable features of the genus. Plant bodies are globe-shaped (Pl. 20: Fig. 3), or cylinder-shaped, the tubercles arranged in more or less continuous ribs, sometimes spiralled. The flowers do not arise from

long, gray, intertwined and frayed spines producing the bird's nest appearance from which the specific name is derived. *T. lophothele* (Salm-Dyck) Br. & R., *T. fossulatus* (Scheid.) Br. & R., and *T. bicolor* (Galeotti) Br. & R.,

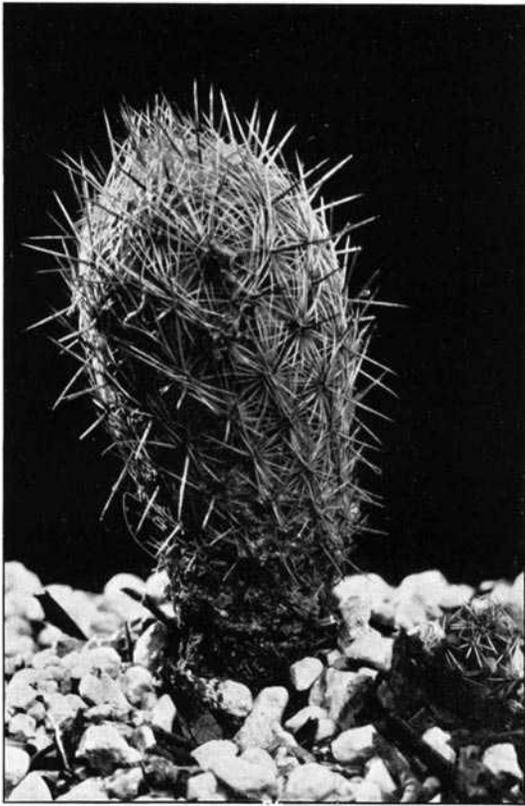


FIG. 128. *Thelocactus hastifer* Werd. & Boed. x 1. Photo courtesy of F. Schmoll, Mexico.

with its several varieties, are all desirable as are most of the species.

RECENT NEW SPECIES SINCE BR. & R.

Here is referred *Thelocactus uncinatus* (Galeotti) Marshall, and *Thelocactus crassihamatus* (Weber) Marshall, both included in the genus *Ferocactus* by Britton and Rose, but both of which produce flowers from the base of a groove at the axil of the tubercles, and both have seeds with basal attachment.

To the species *Thelocactus bicolor* add:

Var. *bolansis* Schum. Stout, milky-white spines, mostly directed upward.

Var. *tricolor* Schum. Densely spiny, the spines red and white.

T. conothelos (Regel & Klein) Knuth. Described as *Echinocactus conothelos* in "The Cactaceae," Vol. IV: pg. 13.

T. Gielsdorffianus Werd., 1929, (*Echinocactus* Werd., *Neolloydia* Knuth). Simple, globose to short cylindrical, bluish-green, 2 or 3 inches in diameter; ribs of confluent, broad, angular tubercles; areoles bearing white wool when young; spines all radial, 6 or 7, spreading, almost an inch long, dark at the tip; flowers ivory white.

T. hastifer (Werd. & Boed.) Knuth, 1931. Simple, cylindrical or clavate, up to 6 inches high, light green;

ribs 18 to 20, tuberculate; areoles bearing white wool when young; radial spines 20 to 25, acicular, spreading, glassy white, about ½ inch long; central spines about 4, white, curved upward, about 1 inch long; flowers about 2 inches long, violet pink.

T. Knuthianus Boed., 1930, (*Neolloydia* Knuth). Simple or cespitose, dark glossy green; ribs formed of confluent, slender tubercles; areoles with white wool; radial spines 18 to 20, needle-like, stiff, spreading, silver white, short; central spine 1, curved upward; flowers an inch long, pale pink.

T. Mandragora (Fric) Berg. Rootstock turnip-like, connected to the plant body by a long, thin neck; stem globose, 2 to 3 inches in diameter, gray-green; broad, four-sided tubercles closely set; areoles with white wool in youth; radial spines about 12, white, subulate, arching inward; central spines usually 2, thicker than the radials, white with a brown tip; flowers white with a green throat; inner petals white with a pink mid-rib.

T. porrectus (Lem.) Borg. This species is listed in the synonymy of *T. leucacanthus* by Britton and Rose, but plants from Mexico under this name are globose to short cylindrical, the conical tubercles in 14 spiralled rows; areoles bearing white wool when young; radial spines 12, acicular, white, spreading; central spines 1 or 2, the upper one ascending and similar to the radials, the lower one porrect, red at first, later gray, acicular; flowers not seen.



FIG. 129. *Thelocactus Saussieri* (Weber) Berg. x 0.6. Photo by R. H. Lahmeyer, Fort Wayne, Indiana.

T. Roseanus Boed. Simple or branching from the base, oval, about 1 inch in diameter and 1½ inches high, pale green; tubercles arranged in rows; areoles with yellow wool when young; radial spines about 15, slender, spreading, yellowish white; central spines 4 to 6, similar to the radials but slightly, curved; flowers pink.

T. Saussieri (Weber) Berg., was described in "The Cactaceae," Vol. IV: pg. 13.

T. subterraneus Bckbg., seems to be a variety of *T. mandragora*.

T. Wagnerianus Berg., is usually considered as a red-spined variation of *T. bicolor*.

T. Ysabelae Schlange, Cact. & Succ. Journ of Amer.,

Vol. V.; pg. 551. Depressed globose, about 2 inches high and 3 inches broad; ribs 13 to 15, tuberculate; radial spines 16 to 20, pectinate, short, white with brown tips; central spine 1, similar to the radials; flowers campanulate, ivory white,

Genus 4. *Echinomastus* Br. & R., 1922. (Pl. 20: Fig. 4.)

This genus is very closely allied to *Thelocactus* having the same habit of producing flowers from the base of a groove extending from the spine-bearing areole to the axil of the tubercles of which the ribs are composed. This character was not mentioned by Britton and Rose, either in the generic or the specific descriptions of the species and was first noted and commented on by J. P. Hester, in the January, 1934, issue of the "Cactus and Succulent Journal of America," Vol. 5 - pg. 503.

Careful examination shows that the vascular supply to the buds divides before reaching the base of the tubercles, and the supply for the spine-bearing bud goes direct to the tip of the tubercle, while that for the flowering bud forks and goes to the areole at the base of the groove in the axil of the tubercle.

Since the principal character on which the sub-tribe CORYPHANTHANA is based, is, "Flowering areoles at the bases or on the sides of the tubercles," it follows that this genus of plants that have their flowering areoles at the base of the tubercles belongs in that sub-tribe and not in the sub-tribe ECHINOCACTANA to which it was previously assigned.

A careful check of the qualifications of the two genera will show that the single point of difference between *Thelocactus* and *Echinomastus* is the point of seed attachment; that of *Thelocactus* being basal, while in *Echinomastus* the attachment is ventral.

Echinocactus Johnsonii Parry, assigned by Britton and Rose to the genus *Ferocactus*, shared with the other species of *Echinomastus* this flowering habit, and we followed Baxter ("California Cactus," 1935), in placing it as *Echinomastus Johnsonii* (Parry) Baxter.

E. uncinatus Galeotti, also placed in *Ferocactus*, with reservations by Britton and Rose, has been assigned here by Knuth, but as the seed attachment in this species is basal it belongs rather in *Thelocactus*.

Habitat: South-western United States and Mexico.

Culture: These desert plants want loose, sandy or gravelly soil to which some gypsum has been added and they do not need much water.

Desirability: The species are attractive but most of them are difficult to grow.

Desirable species: *Echinomastus unguispinus* (Engel.) Br. & R., and *E. Macdowellii* (Reb.) Br. & R., are rare but most attractive; *E. erectocentrus* (Coult.) Br. & R., *E. intertextus* (Engel.) Br. & R., *E. dasyacanthus* (Engel.) Br. & R., *E. durangensis* (Runge) Br. & R., *E. Johnsonii* (Parry) Baxter, and *E. arizonicus* nom. nud. are available.



FIG. 130. *Echinomastus erectocentrus* (Coult.) Br. & R. x 0.5. Note sulcations from tip to base of tubercles. Photo by Oliver Young, Bridgton, Maine.

Genus 5. **Mamilloopsis** (Morren) Weber.

The two species known are very attractive due to the globose bodies (Pl. 20: Fig. 5), densely covered with long bristle-like, white spines which completely hide the body. Surmounted by

large funnel-shaped, orange or red flowers. They are extremely difficult to grow on their own roots but do fairly well grafted. *M. senilis* is rare while *M. Diguetii* is practically unknown.

Genus 6. **Cochemiea** (Brand.) Walton, 1899.

A genus of five known plants limited to Baja California in Mexico. The stems are cylindrical (Pl. 21: Fig. 6), long, sometimes trailing and densely spiny, usually with one central spine strongly hooked, but sometimes with all spines straight. The flowers are scarlet, diagonal and the sepals are also scarlet and spread below the petals, thus making the flower appear double. The red fruits are berry-like.

Culture: Very well drained, loose soil with a heavy leaf-mold content is desirable. Water can be supplied liberally in warm weather but should be used very sparingly in cold season.

Desirable species: *Cochemiea poselgeri* (Hild.) Br. & R., is the most popular species and forms long stems which become trailing in age. *C. halei* (Brand.) Walton, and *C. setispina* (Coul.) Watson, are obtainable but are rare. *C. pondii* (Green) Walton, is extremely rare.

RECENT NEW SPECIES SINCE BR. & R.

Cochemieamaritima Lindsay, Cact. & Succ. Journ. of Amer., Vol. VIII: pg. 143, 1937. Cespitose, the clusters to 3 feet in diameter and up to 20 inches high; roots thickened, somewhat jointed, corky; stems 1 to 3 inches in diameter, glaucous, tuberculate; tubercles sub-conic, becoming corky in age; areoles bearing gray wool in youth; radial spines 10 to 15, reddish-brown, acicular, about 1/2 inch long; central spines 4, reddish,

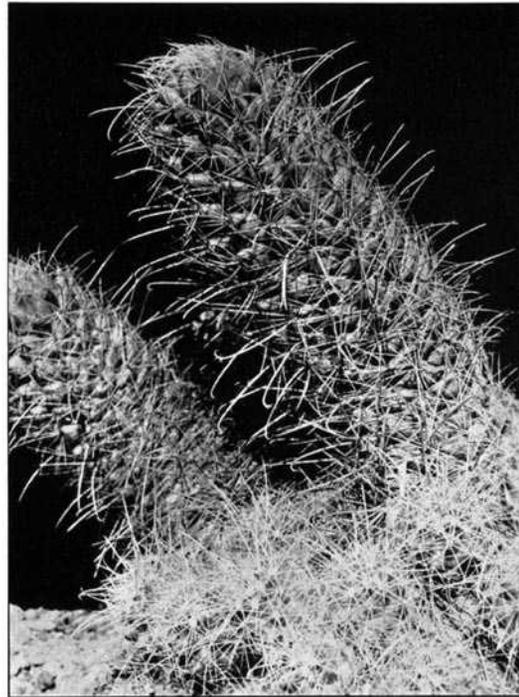


FIG. 131. *Cochemiea setispina* (Engel.) Walton x 0.5.
Photo by Graham Heid.

acicular, the three upper ascending straight, the lower one porrect, hooked, 1 to 2 inches long; flowers from axils of tubercles, scarlet.

Genus 7. **Coryphantha** (Engel.) Lemaire, 1868. (Pl. 21: Fig. 7.)

This group was formerly associated with *Mammillaria*, from which it was separated because of the following differences: grooves on the upper side of the tubercles; flowers borne at the base of the grooves on young tubercles near the top of the stem; greenish or yellowish fruit ripening very slowly with perianth persistent. The plant body is globe-shaped to cylinder-shaped, either solitary or clustered, and covered

with tubercles or nipples sometimes arranged in rib-like rows.

Habitat: United States, Mexico, and Cuba.

Culture: Two distinct types of plants are represented in the 65 or more species of *Coryphantha*.

The first is distinctly a desert plant and requires a gravelly soil with added gypsum and perfect drainage. Water should be applied very



FIG. 132. *Coryphantha pallida* Br. & R. x 0.75. Photo by R.H. Lahmeyer, Fort Wayne, Indiana.

sparingly to this type of plant. Species included in this group of plants are: *Coryphantha recurvata*, *C. Muehlenpfordtii*, *C. echinoidea*, *C. robustispina*, *C. pectinata*, *C. Nickelsae*, *C. sulcolanata*, *C. Palmeri*, *C. cornifera*, *C. Salm-Dyckiana*, *C. echinus*, *C. durangensis*, *C. chlorantha*, *C. vivipara*, *C. neomexicana*, *C. arizonica*, *C. deserti*, *C. aggregata*, and *C. sulcata*.

The second type of plant which includes about all species not mentioned above, except *C. cubensis*, will take a richer soil containing leafmold and will stand considerably more water. *C. cubensis* has just been relocated, and it does best when grafted.

Desirability: Many species, especially in the second group, are showy or unique and are very popular in collections. The desert types, however, are very difficult to grow and consequently less desirable. Seed-grown plants are preferable.

Desirable species: *Coryphantha elephantidens* Lem., *C. bumamma* (Ehren.) Br. & R., *C. macromeris* (Engel.) Lem., *C. clava* (Pfeiff.) Lem., and *C. erecta* Lem., are recommended.

RECENT NEW SPECIES SINCE BR. & R.

Coryphantha Andraea Boed. (*Mammillaria* Boed.), 1928. Globose, glossy dark green, about 4 inches in diameter, axils and top very woolly; tubercles crowded,

plump, roundish, with a deep woolly groove; radial spines about 10, brown tipped, spreading; central spines 5 to 7, thicker and stiffer, up to 1 inch long, darker than the radials and incurved; flowers 2 inches or more broad, pale yellow.

C. asterias (Cels) Boed. (*Mammillaria* Cels.). Simple, globose, gray-green, 4 or more inches high; tubercles thick, of soft texture, the groove often inconspicuous, axils with white wool which hides a red gland; radial spines 9, spreading; central spines 1 or 2, the lower one hooked; all spines stiff, bulbous at base, yellowish with brownish tips; flowers white to pink.

C. Bergeriana Boed., 1929, Nuevo Leon. Simple, clavate; tubercles in 8/12 series, grooved and bearing 1 or 2 red glands; areoles at first woolly; radial spines 18 to 20, spreading, acicular; central spines 4, subulate, yellow with dark tips; flowers yellow.

C. Borwigii Purpus, 1927, Coahuila, Mexico. Oval, bluish-green, to 4 inches high and 2 to 3 inches in diameter; tubercles conical; axils woolly when young; radial spines on young areoles erect, in a brush-like bundle, about 1/2 inch long; central spines on new areoles 3, stiff, bulbous at base, the upper one curved laterally and, like the other two, dirty white to brownish with a darker to black tip; flowers large, pale yellowish-green with reddish outer petals.

C. calochlora Boed., 1933. Globose, dark green; radial spines 12 to 15, whitish; central spines 3 to 5; flower small, cream, "The Cactaceae," Vol. IV: pg. 50.

C. cornuta (Hild.) Berg., Mexico. Described in "The Cactaceae," Vol. IV: pg. 50.



FIG. 133. *Coryphantha clava* (Pfeiff.) Lem. x 0.33. Photo by R.H. Lahmeyer, Fort Wayne, Indiana.

C. densispina Werd., 1932, Coahuila, Mexico. Globose; radial spines 25, acicular, grayish, ½ inch long; central 4 subulate, about an inch long; flower 2 inches wide, golden.

C. fragrans Hester, 1941, is a well known form of *C. neomexicana*.



FIG. 134. *Coryphantha elephantidens* Lem. x 0.5. Photo by Count F. M. Knuth, Denmark.

C. Georgii Boed., 1931, San Luis Potosi, Mexico. Simple, glossy green, less than 2 inches high and 3 inches in diameter; tubercles conic, of flabby texture, with a narrow, bare groove; areoles at first white woolly; radial spines 8 to 9, acicular, spreading, grayish to whitish with brown tips, short; central spine 1 or more.

C. gladiispina (Boed.) Berg., 1925, Parras, Coahuila. Simple, glossy-green, less than 2 inches high and 3 diameter, deep green to gray; tubercles directed upward, the grooves bare; areoles round, naked; radial spines 17 to 20 of which the 7 to 8 upper ones form a brush-like bundle, ashy gray, nearly an inch long, black tipped, the lower 10 to 12 shorter, acicular, spreading, glassy gray; central spines 4, the lower one 1 inch long, curved backward, the others curved upwards, all bulbous at base, ashy gray with dark tips; flowers yellow.

C. Hesteri Wright., Cact. & Succ. Journ. of Amer., Vol. 4: page 274, Brewster County, Texas. Simple or clustered, depressed-globose; tubercles in ⅝ series, conical, sulcate; axils naked; areoles orbicular, woolly at first; radial spines 16 to 22, glassy-white, stiff; central spines wanting; flowers small, light purple, about 1 inch broad.

C. longicornis Boed., 1931, Durango, Mexico. Simple, globose to short cylindrical, up to 8 inches tall and 4 inches thick, glossy green; tubercles conical with a narrow, bare groove; areoles woolly when young; axils bare with one gland; radial spines 12, white, acicular, straight or curved, short, gray at tips; central spines 3, stiff, brown, the upper one short, the lower one curved downward, about 1 inch long; flowers pure yellow.

C. Pottsii (Scheer) Berg., 1850., (*Mammillaria Pottsii* Scheer). This *Coryphantha* has been confused with *Mammillaria leona* Poselger, 1853, as is evident from the copious notes on the herbarium material in "The Cactaceae," Vol. IV: pg. 137. Cespitose, stems cylindrical up to 8 inches high and 1 inch in diameter; tubercles ovate, with a very narrow groove; axils slightly woolly; radial spines numerous, acicular, white, equal; central spines 7, stronger, the upper one curved upwards, tipped reddish-brown; flower unknown.

C. pseudoechinus Boed., 1929, Coahuila, Mexico. Similar in general appearance to *C. echinus* but with a pink flower.

C. reduncuspina Boed., 1933, central Mexico. Simple, globose, 4 inches in diameter; tubercles in 13/21 series; young areoles somewhat woolly; radial spines 15 to 20, acicular, short; central spines 2 to 3 or more, subulate, nearly an inch long; flowers-Pale yellow.

C. Roederiana Boed., 1929, Coahuila. Simple or cespitose, oval, glossy green, about 4 inches high; tubercles conical, with a narrow, bare groove; areoles very woolly when young; axils hairy, without glands; radial spines 10 to 12, acicular, spreading, gray with brown tips; central spine 1, stiff, brown; flowers pale yellow.

C. Schwartziana Boed., 1932, Guanajuato. Globose; areoles oval; radial spines 20, acicular, grayish, short; central spine 1, subulate, horn-colored; flowers unknown.

C. scolymoides (Scheid.) Boed., is considered a valid species by some contemporary writers, although it is nearly indistinguishable from *C. cornifera*.

C. speciosa Boed., 1929, Coahuila. Simple, spherical to ovate, bluish-green; tubercles stout cylindrical, 1 inch long- radial spines 7 to 9 grayish, sometimes black at the tip, spreading; central spines 4; flowers over 2 inches wide, golden.

C. unicornis Boed., 1928, Coahuila. Cespitose, globose, glossy blue green; tubercles conical, flabby; ½ inch long, with a narrow bare groove; axils woolly with a red gland; radial spines 7 to 9, acicular, spreading ½ inch long; central spine 1, nearly an inch long, straight; all spines whitish with reddish-brown tips.

C. Vaupeliana Boed., 1928, Tamaulipas. Simple, ovoid; tubercles 3 sided, sulcate; radial spines 15, grayish yellow, red tipped; central spines 4, yellow with rust red tips; a red gland in the groove; flowers yellow.

C. Vogtherriana Werd. & Boed., 1932, San Luis Potosi. Simple, depressed globose, gray-green; tubercles distant, conical, scarcely sulcate; areoles at first

woolly; radial spines 5 or 6, flatly spreading, acicular, white to rust color with black tips; central spines wanting, or rarely 1 of the lower spines curved or hooked; axils densely woolly and bearing red glands; flowers pale yellow.

C. Werdermannii Boed., 1929, Coahuila. Simple,

globose to short cylindrical, at first forming small tubercles but these larger when plant is about 2 inches in diameter; areoles elliptic, bare; radial spines 15 to 20, pectinate, pale gray, short; in age, 4 horn-colored central spines up to 1 inch long first appear; flowers pure yellow.



FIG. 135. *Neobesseya missouriensis* (Sweet) Br. & R. x 0.6. Photo by Scott Haselton in the author's garden.

Genus 8. *Neobesseya* Br. & R., 1923.

Small heads (Pl. 21: Fig. 8), frequently forming large clusters, the off-sets starting from the grooves on the upper side of old tubercles, in contrast with the flowers which come from the grooves on young tubercles. Flowers large, yellow or pink followed by globe-shaped red fruit. The 6 known species are nearest to *Coryphantha* but have very different fruit and seeds.

Under garden culture the 4 original species are practically indistinguishable and convenience might best be served if they were united under the oldest name.

Habitat: The Great Plains of the United States extending north to Montana and south into Mexico.

Culture: Well drained but fairly rich soil with liberal water in warm weather.

Desirability: Though attractive, they are rather difficult to grow.

Desirable species: *Neobesseya missouriensis*

(Sweet) Br. & R., is the usual species found in collections, but the other three older species are available.

RECENT NEW SPECIES SINCE BR. & R.

Neobesseya asperispina Boed., Coahuila. Usually simple, globose; tubercles conical, flabby, pointed, over ½ inch long, flattened on upper side and with a superficial groove; young areoles slightly woolly; axils bare; radial spines 9 to 10, slender, stiff, grayish, short, at first spreading outward, later flatly spreading; central spine usually absent but sometimes appearing on young areoles; flowers slightly over an inch long, greenish-yellow.

N. Zilziana Boed., 1930, Coahuila, (*Coryphantha* Boed.). Slightly cespitose, stems short cylindrical, slightly over 2 inches high and 1½ inches in diameter, glossy bluish-green; tubercles oval, slender and with a bare groove; areoles and axils bare; radial spines 12 to 15, acicular, stiff, spreading, white with brown tips, about ½ inch long, 4 to 7 other spines in a brush arrangement at the upper part of the areole; central spines wanting; flowers 1 inch long, lemon-yellow with brown-tips.

Genus 9. *Escobaria* Br. & R., 1923.

In appearance (Pl. 21: Fig. 9), like the desert types of *Coryphanthas*, their tubercles are grooved on the upper side. The flowers are pink and small and the fruits red and the old tubercles near the base of the plant remain as woody knobs after losing their spines.

Habitat: Texas to Arizona and Mexico.

Culture: Very well drained, gravelly soil with added gypsum. Water sparingly and only in warm weather. They are very hard to grow under even the best circumstances.



FIG. 136. *Escobaria tuberculosa* (Engel.) Br. & R. x 0.25. Photo by C. W. Armstrong, Vancouver, B.C.

Desirable species: *Escobaria tuberculosa* (Engel.) Br. & R., *E. dasyacantha* (Engel.) Br. & R., and *E. Runyoni* Br. & R., are most frequently seen but other species are obtainable.

RECENT NEW SPECIES SINCE BR. & R.

Escobaria albicolumnaria Hester, 1941, is merely a form of *E. tuberculosa*.

E. Emskoetteriana (Quehl.) Berg., and *E. Fobei* Fric, also known as *Fobea viridiflora* Fric, are both referred to *Escobaria dasyacantha* (Engel.) Br. & R.

The two species *E. bisbeeana* Orcutt, from Bisbee, Arizona, and *E. Leei* Rose in Boed., 1932, from Texas, have been described but not re-collected as far as is known.

E. Orcuttii Boed., 1932, from Texas, is unknown to us.

E. Mühlbaueriana (Boed.) Knuth (*Coryphantha* Boed.), Mexico. Ovoid to sub-cylindric, cespitose, apex Umbilicate; tubercles in $\frac{3}{8}$ series, grooved halfway down, club-shaped, areoles spherical, naked; radial spines 15 to 20, spreading flatly, acicular, white with red tips; central spines 6; axils naked; flowers yellowish.

E. varicolor Tieg., 1932, Texas. Simple, sub-ovoid, slightly over 2 inches high and wide, green; tubercles in $\frac{13}{21}$ series, conic, deep naked grooves; young areoles with white wool; radial spines 15 to 18, short, acicular, dirty white; central spines 4, thicker and longer than the radials and with swollen bases; flowers small, pale rose.

Genus 10. *Bartschella* referred to *Mammillaria*

A genus of one species (Pl. 21: Fig. 10), separated from *Mammillaria* because of the larger flower, resembling a *Coryphantha* flower. The tubercles are not grooved and the seeds are dull black, pitted, and with narrow cylindrical base separated from the bulk of the seed by a constriction.

Numerous species of *Mammillarias*, however, have equally large flowers such as *M. Wrightii*, *M. longiflora* and *M. Baumii*. Dull, black seeds are also found in species of *Mammillarias*, and sometimes the constricted seed. For these reasons convenience is best served by discarding this monotypic genus and considering the one species as *Mammillaria Schumannii* Hild. It is from the cape district of Lower California, and is a most attractive plant but very difficult to grow unless grafted on a husky stock.



FIG. 137. *Mammillaria Schumannii* Hild. x 0.75. Photo by Graham Heid.



FIG. 138. *Pelecyphora aselliformis* Ehrenb. x 1. Photo by J. R. Brown.

Genus 11. **Pelecyphora** Ehrenberg, 1843. (Pl. 2 1: Fig. 11.)

A Mexican species of small plants with flattened tubercles of a hatchet-shape, from which the generic name, *Pelecyphora*, or "hatchet-bearer" is derived. The bell-shaped flowers arise near the center of the plant from a mass of wool or hairs. The three species of this genus are all rare in cultivation and rather difficult to grow, although when treated like *Mammillarias* they produce numerous flowers.

Pelecyphora aselliformis Ehrenb., is the type

species and the one most frequently seen in collections.

RECENT NEW SPECIES SINCE BR. & R.

Pelecyphora pseudopectinata Bckbg., 1935, northern Mexico. Simple, globose to somewhat elongated; apex depressed; tubercles compressed, base quadrangular; axils naked, areoles very woolly; spines pectinate; flowers rosy-white; fruit small, dark green.

P. Valdeziana Moll., 1930, (*P. plumosa* Boed. & Ritt.). Simple, globose to short cylindric, blue green; areoles small, woolly; axils naked; radial spines about 30, very short; flowers from apex of plant.

Genus 12. **Phellosperma** referred to **Mammillaria**.

A genus of one species (Pl. 22: Fig. 12), that in all respects resembles a *Mammillaria* of the hooked-spinetype. The rootstocks are elongated, carrot-shaped or branched, the tubercles are flabby, not milky and not grooved. The relatively large, funnel-shaped flowers, are rose-colored and the seeds are dull black with a thick, corky base nearly as large as the body, and from this factor the generic name "cork-seed" is derived.

This one characteristic of a corky based seed is

insufficient for the erection of a genus especially as a number of *Mammillaria* seeds show a corky tendency to a lesser extent, notably *M. Blossfeldiana*.

Convenience would best be served by discarding this monotypic genus and considering *Phellosperma tetrancistra* by its first name *Mammillaria phellosperma* Engel.

It is found sparingly in California, Arizona, Nevada and northern Baja California, but does not do well in cultivation.



FIG. 139. *Mammillaria phellosperma* Engel. Flowered and photographed by Oliver Young, Brigton, Maine.

Genus 13. **Dolichothele** (Schum.) Br. & R., referred to **Mammillaria**.

The generic name is from the Greek words meaning "long" and "nipple" referring to the elongated tubercles (Pl. 22: Fig. 13).

The three species of *Mammillaria*-like plants were referred to *Dolichothele* by Britton and Rose, who erected the genus because of the elongated, soft textured tubercles, the very large funnel-shaped flowers, and the non-milky sap.

Many species of *Mammillaria* have long tubercles and are soft in texture, notably *M. Wrightii*, *M. viridiflora* and the new *M. Baumii*. All of these species and others of the *Mammillarias* have long tubular flowers.

We therefore unite this genus with *Mammillaria* and list the species under their original binomials as follows:

Mammillaria sphaerica Dietrich, 1853.

Mammillaria longimamma De Candolle, 1828.

Mammillaria uberiformis Zuccarini, 1837.

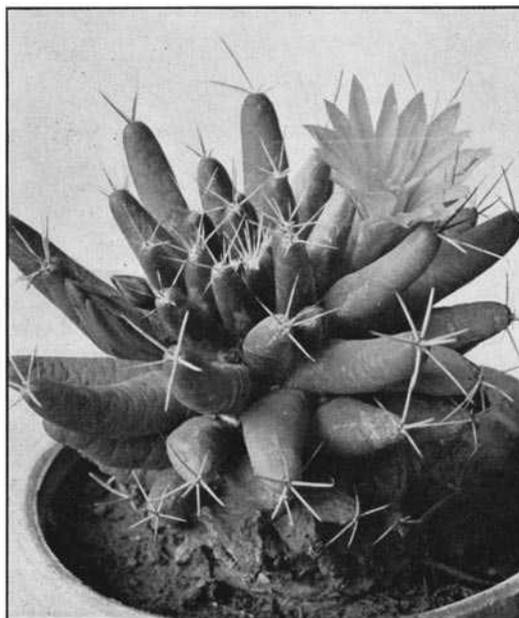


FIG. 140. *Mammillaria longimamma* (*Dolichothele longimamma* D.C.). Photo courtesy McCabe Cactus Gardens.

Genus 14. **Porfiria** Boedeker, 1926.

A recent monotypic genus of one species, *Porfiria Schwartzii* Boed. (*P. coahuilensis* Boed., and *Haagea Schwartzii* Fric). Small, Mammillaria-like plant with a thick turnip-like root, stem flattened at the top, milky juice. The flowers borne in the axils of the tubercles are peculiar

in having a protruding ovary (Pl. 22: Fig. 14). Fruit is red, clavate, and ripens a year after flowering.

Culture: Give plants of this genus the same care as for Mammillaria. The plant is interesting only to collectors.

Genus 15. **Solisia** Britton and Rose, 1923.

Another monotypic genus from Mexico (Pl. 22: Fig. 15), *Solisia pectinata* (Stein) Br. & R., resembles *Peleciphora* with which it was once included. The juice of *Solisia*, however, is milky and the small yellow flowers are from the side of the plant while the larger purplish flowers of

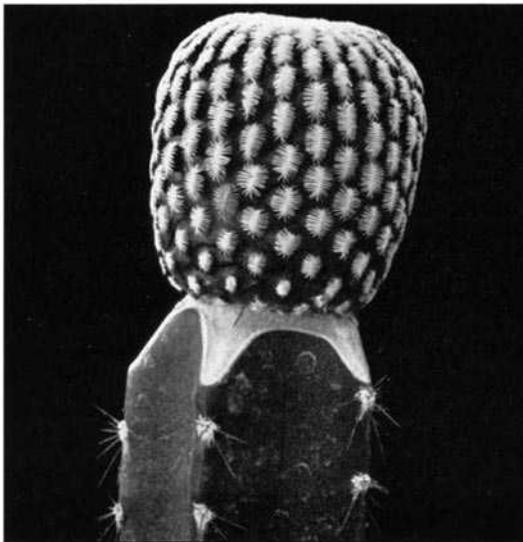


FIG. 141. Grafted plant of *Solisia pectinata* (Stein) Br. & R. x 1. Photo by Graham Heid.

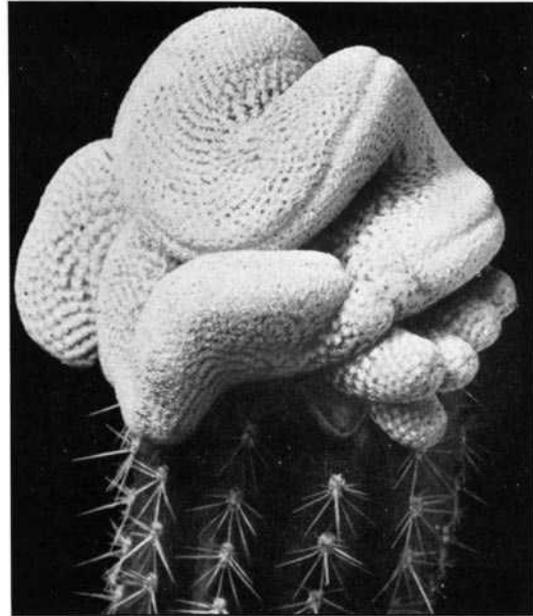


FIG. 142. Grafted plant of *Solisia pectinata* (Stein) Br. & R., cristate and normal, x 1.5. Photo by Oliver Young, Bridgton, Maine.

Peleciphora are borne at the apex of the plant.

The culture is rather difficult and the species is rather a collectors' item.

Genus 16. **Mammillaria** Haworth, 1812.

Syn.: *Neomammillaria* Br. & R.

The genus *Mammillaria* was so named by Haworth because of the nipple-like tubercles (Pl. 22: Fig. 16), of all the species. At that time the Latin "Mamilla" was spelled with one or two m's at option, therefore the spelling chosen by him was correct and later attempts to change the spelling to *Mamillaria* were unjustified. (See Cact. & Succ. Journ. of Amer., Vol. 12: pg. 144).

Britton and Rose, noting that the name *Mammillaria* had been used for a genus of Algae by

Stackhouse in 1809, added the prefix "Neo" because the American Rules, then in force, prohibited the use of a generic name which had been previously used.

According to International Rules, the name *Mammillaria* is conserved for the genus of cacti because the genus of Stackhouse never came into general use while that of Haworth was generally accepted. *Mammillaria* as a generic name for cacti is therefore a nomina conservanda.



FIG. 143. A fine collection of Mammilarias

The genus had 150 species when "The Cactaceae" was printed in 1923 and several species have been described since then, most of which are briefly described here.

Dealers both here and in Mexico offer plants under many names that have never been published and this has resulted in considerable confusion as to the exact number of valid species. In addition, many of the names relegated to

synonymy by Britton and Rose have been revived, usually without possible justification.

The species here described are not, of necessity, valid species and some of these new descriptions may later be assigned to the synonymy of known plants, but all of the available descriptions of plants in this genus since 1923 are listed here.

Contemporary writers are unanimous in the

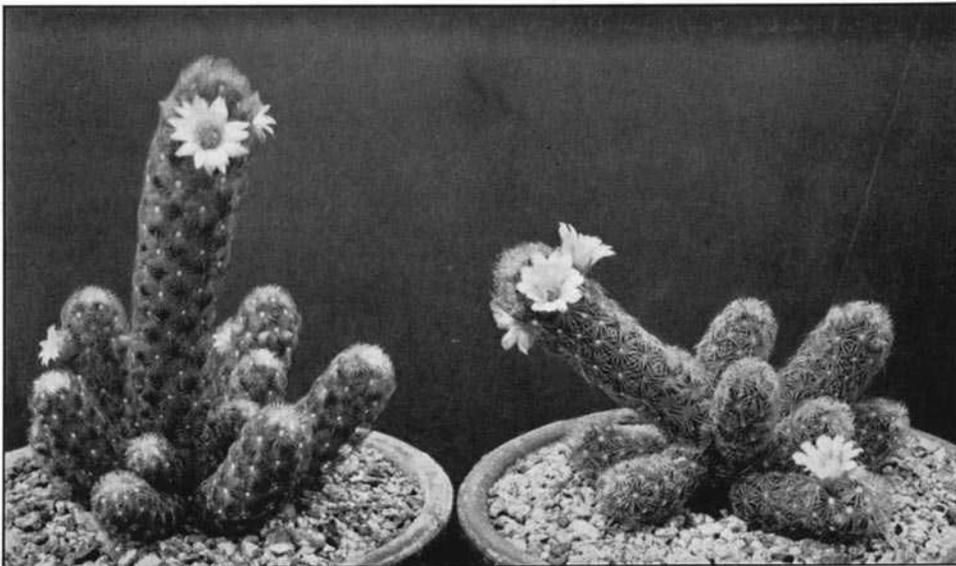


FIG. 144. *Mammillaria elongata* D.C. var *minima* Schelle x 0.6
by Oliver Young Britton, Maine.

use of the system of classification of the Mammillarias formulated by Alwin Berger and we follow Dr. Borg's modification of that classification by placing the species in series as follows:

Section 1. **HYDROCHYLUS** K. Schumann

Species with watery sap; stems green.

- A. Stems clustering, cylindrical, slender, of unequal length. Spines radiating, yellow Series 1. **Leptocladodeae** K. Schumann
- B. Stems clustering or solitary; stems of about the same height.
- a. Radial spines usually very numerous, irregularly spreading, white, often entirely covering the stem, this somewhat flattened at the apex Series 2. **Candidae** K. Schumann
- aa. Radial spines less numerous, not irregularly spreading, stem often cylindrical.
- b. Radial spines thin, often mixed with long hairs. Tubercles cylindrical or narrowly conical. Central spines straight, curved or hooked Series 3. **Stylothele** K. Schumann
- bb. Radial spines stiffer, subulate, sometimes wanting.
- c. Radial spines numerous (about 30), obliquely directed upward. Central spines almost like the radials Series 5. **Polyacanthae** Salm-Dyck
- cc. Radial spines spreading outwards. Central spines differing markedly from the radials.
- d. At least one central spine hooked Series 4. **Ancistracanthae** K. Schumann
- dd. Central spines not hooked or occasionally one of them is hooked Series 6. **Heterochlorae** Salm-Dyck

Section 2. **GALACTOCHYLUS** K. Schumann

Species with milky sap. Stems more or less grayish-green or gray, and firmer in texture.

- C. Tubercles not milky, the milky sap only in the body of the plant. Radial spines very numerous, the centrals strong Series 7. **Elegantes** K. Schumann
- D. Tubercles exude a milky sap when wounded.
- a. Radial spines radiating and spreading outwards, white, numerous, thin Series 8. **Leucocephalae** Lemaire
- aa. Radial spines less radiating and spreading. Tubercles large, more or less angular.
- b. Axils of tubercles naked Series 9. **Macrothelae** Salm-Dyck
- bb. Axils woolly and with bristles Series 10. **Polyedrae** Pfeiffer

Section 1. **HYDROCHYLUS**

Series 1. **Leptocladeae**. To this section the following species recorded in "The Cactaceae" are assigned. The numbers of the species are from Britton and Rose keys in Vol 4:

96. *Mammillaria elongata* D.C. and its varieties which include:
- var. *anguinea* Schum. (*M. anguinea* Otto). Tubercles higher; radial spines yellow with brown tips - one darker central spine; Stems thicker and longer.
- var. *echinata* Schum. (*M. echinaria* D.C.). Stems stronger, erect, more freely sprouting; radials 20, yellow; centrals 2 or 3, brown.
- var. *rufocrocea* Schum. (*M. rufocrocea* Salm-Dyck). Stems prostrate; radial spines yellow at base, white in middle, tipped brown; centrals 1 or 2.

var. *stella-aurata* Schum. (*M. stella-aurata* Mart.).

Stems slender, freely sprouting; radial spines golden yellow, or red tipped; central spine 1

var. *tenuis* Schum. (*M. tenuis* D.C.). Stems slender, spines shorter, 1 central.

var. *minima* Schelle. Stems slender and short, radials appressed, central wanting.

var. *Schmollii* Hort. Stems very slender, up to 4 inches long, spines deep yellow.

var. *viperina* (*M. viperina* Purp.). Stems sprawling, slender, spines numerous, densely clustering, snow white to dark brown.

RECENT NEW SPECIES SINCE BR. & R.

Mammillaria microbelia Werd., Queretaro. Simple or cespitose, cylindrical, to 6 inches high and 1½ inches in diameter; tubercles short, conical; axils at first with dark wool; areoles with white wool when

young; radial spines about 50, bristly, white, golden yellow or reddish-brown at base; central spines 1 to 4, absent from the lower areoles, erect at the top of plant, red or reddish-brown; flowers white.

M. microheliopsis Werd., is similar to the preceding; radials 30 to 40; centrals always present, 6 to 8, pale gray to pinkish or dark brown; flowers purplish-red.

Series 2. **Candidae**. Includes the following species described in "The Cactaceae":

90. *Mammillaria candida* Scheid. (*M. Humboldtii* Ehrenb.)
 89. *M. lenta* K. Brand,
 102. *M. albicans* (Br. & R.) Berg.
 87. *M. lasiacantha* Engel.
 88. *M. denudata* Engel.
 97. *M. Oliviae* Orcutt.
 86. *M. Schiedeana* Ehrenb (*M. dumetorum* Purp.)
 81. *M. plumosa* Weber.
M. longimamma D.C. (*Dolichothele* Br. & R.)
M. sphaerica Dietr. (*Dolichothele* Br. & R.)
M. uberiformis Zucc. (*Dolichothele* Br. & R.)
 (Transferred from Br. & R., *Dolichothele*)

RECENT NEW SPECIES SINCE BR. & R.

M. Baumii Boed., Tamaulipas. Globose, cespitose, glossy green, 3 inches high, of a soft texture; tubercles slender, conic, bearing long white hairs in their axils; spines all white; radial spines 30 to 35, very slender almost hair-like; central spines 5 or 6, stiffer, straight, pale brown at base; flower 1 inch long, glossy yellow.

M. cephalophora Quehl., San Luis Potosi. Simple, globose, dark glossy green, 3 inches high; tubercles cylindrical, directed upwards; axils naked; spines up to 30, in two series, radiating, bulbous at base, the tip drawn out into silky hairs, white, with a golden or brownish sheen; flowers pale pink.

M. estanzuelensis Berg., 1929. Globose, light green; spines all white, acicular.

M. Halbingeri Boed., 1932, Oaxaca. Simple, globose, bright green; tubercles conical; areoles with short wool when young; radial spines 25, acicular, white; central spines 2, subulate, white with brown tips; flowers small, sulphur color.



FIG. 145. *Mammillaria Herreraei* Werd. x 0.5. Photo from Germany.

M. Herreraei Werd., 1931, Queretaro. Cespitose with small, smooth, round or oval stems, like small balls of cotton; axils of small tubercles naked; spines all radial, 100 or more, very short, white, radiating; flowers 1 inch long, pale pink to purplish.

M. roseocentra Boed. & Ritt., 1931, Coahuila, has been described.

M. Ortiz-Rubiona (Bravo) Werd., Queretaro. Cespitose forming large groups, stems globose, flattened, to 4 inches in diameter; tubercles cylindrical, axils with numerous, white bristles; radial spines, short, white, spreading; central spines 4 to 6, stronger than the radials, white, with reddish tips; flowers rosy yellow.

Series 3. **Stylothelae** (a. **Rectispinae** — spines straight) includes the following species described in "The Cactaceae":

82. *M. prolifera* (Mill.) Haw. (*M. pusilla* D.C.,
M. multiceps Salm-Dyck)
 91. *M. vetula* Mart.
 101. *M. sphacelata* Mart.
 93. *M. decipiens* Scheid.

RECENT NEW SPECIES SINCE BR. & R.

Mammillaria albicoma Boed., Tamaulipas. Cespitose, very small; radial spines 30 to 40, in two series, hair-like, white, glossy and soft; central spines 3 or 4, sometimes wanting; axils of tubercles bear white wool and a few white bristles; flowers glossy white or yellowish.

M. picta Meinshausen, was mentioned in "The Cactaceae," Vol. 4: pg. 169.



FIG. 146. *Mammillaria Viereckii* Boed. x 1. Photo from Germany

M. Viereckii Boed., Tamaulipas. Usually simple, globose, dark green, small; tubercles soft, slender; axils slightly woolly and bristly; radial spines 10, acicular, yellow to golden; flowers creamy yellow.

Series 3. **Stylothelae** (b. **Tortispinae**—spines twisted or arching, not hooked) includes the following species described in "The Cactaceae":

84. *M. camptotricha* Dams

Series 3. **Stylothelae** (c. **Hamatispinae**—at least one central spine hooked) includes the following species described in “The Cactaceae”:

122. *M. Schelhasei* Pfeiff.
 118. *M. bocasana* Poselg.
 117. *M. longicoma* (Br. & R.) Berg.
 116. *M. multibamata* Boed.
 114. *M. Kunzeana* Boed. & Quehl.
 125. *M. Painteri* Rose (*M. erythrosperma* Boed.)
 115. *M. hirsuta* Boed.



FIG. 147. *Mammillaria longicoma* Br. & R. x 0.5. Photo by Oliver Young, Bridgton, Maine

111. *M. Siedeliana* Quehl.
 123. *M. glochidiata* Mart.
 110. *M. Wildii* Dietr.
 109. *M. pygmaea* (Br. & R.) Berg. (*M. sinistrohamata* Hort.)
 119. *M. multiformis* (Br. & R.) Boed.

RECENT NEW SPECIES SINCE BR. & R.

Mammillaria erectohamata Boed., San Luis Potosi. Cespitose, glossy light green, globose; tubercles cylindrical; axils with a few white bristles - radial spines 25, very slender, white, radiating, short; central spines 2 or 3, purplish-red to dark brown, the upper one erect and straight, the lower one curved upward and hooked, flowers white.

M. gilensis Boed., has been described.

M. Haebneliana Boed., 1934, San Luis Potosi. Globose, simple or branching from the base; tubercles in 8/13* series, compact, terete; radial spines 25, white, flatly spreading; central spines 5 to 7, hooked, amber colored; axils of tubercles naked; flowers straw-colored.

M. icamolensis Boed, 1933, Nuevo Leon. Simple, globose to cylindrical, small ; tubercles in 13/21* series

* The figure 13/21 indicates that the spiralled tubercles are in rows of 13 from right to left and the 21 from left to right.

densely crowded, cylindrical; areoles round, naked except at apex; radial spines 16 to 20, white hair-like, flatly spreading; central spines 4, base swollen, of equal length, some hooked; flowers rose-colored.

M. Knebeliana Boed., 1932, Guanajuato. Simple or cespitose, short cylindrical, small; apex flat, not woolly but covered with spines; tubercles in 13/21 series, green, cylindrical; radial spines 20 to 25, white, hair-like, flatly spreading; centrals at first 4, later 5 to 7, acicular, porrect, rust colored, hooked; flowers yellow.

M. leucantha Boed., 1933, San Luis Potosi. Simple, 1 inch in diameter; apex not depressed, but covered by erect spines; tubercles terete in 8/13 series, widely spaced; areoles naked; radial spines about 18, white, flatly spreading; central spines 3 to 4, bases swollen, hooked; flowers white.

M. phitauiana (Baxter) Werd., Baja California. Simple or cespitose, cylindrical, light green, about 6 inches high; tubercles conical; radial spines about 24, straight, soft and bristle-like, radiating, white; central spines 4, white at base, tipped brown, at least one hooked; flowers white.

M. pubispina Boed., Hidalgo. Simple, globose, dull light green; tubercles cylindrical with slightly woolly areoles; radial spines about 15, hair-like, spreading, mixed with curled hairs, white; central spines 4, like radials but with brown or reddish brown tips, the lowermost hooked; flowers white or cream with a pink midrib.

M. Zeilmanniana Boed., 1931, Guanajuato. Simple or cespitose, oval to short cylindrical, glossy green, spiny at apex; tubercles oval; areoles woolly when young; radial spines 15 to 18, radiating, white, hair-like; central spines 4, reddish-brown, the lower one slightly longer and hooked; flowers pale violet to purplish-red.

Series 4. **Ancistrocanthae**. Includes the following species described in “The Cactaceae”

144. *M. fasciculata* Engel.
 100. *M. mazatlanensis* Schum.
 163. *M. longiflora* (Br. & R.) Berg.
 131. *M. microcarpa* Engel. (*M. Milleri* Br. & R.)
 138. *M. Goodridgei* Scheer.
 124. *M. trichacantha* Schum.
 137. *M. dioica* Brand.
 130. *M. Boedekeriana* Quehl.
 139. *M. zephyranthoides* Scheid.
 126. *M. Wrightii* Engel.
 128. *M. Wilcoxii* Toumey
 129. *M. Wilcoxii* var. *viridiflora* Br. & R. (*Neomammillaria viridiflora*)
 142. *M. bombycina* Quehl.
 149. *M. Verhaertiana* Bed.
 129. *M. Mainae* Brand.
 134. *M. Armillata* Brand. (*M. La Pacina* Gates)
 147. *M. tacubayensis* Fedde.
 135. *M. Fraileana* (Br. & R.) Berg.
 133. *M. Sheldonii* (Br. & R.) Berg.
 136. *M. Swinglei* (Br. & R.) Berg.
 106. *M. hamata* Lehm.
 141. *M. jaliscana* (Br. & R.) Berg.
 143. *M. occidentalis* (Br. & R.) Berg.

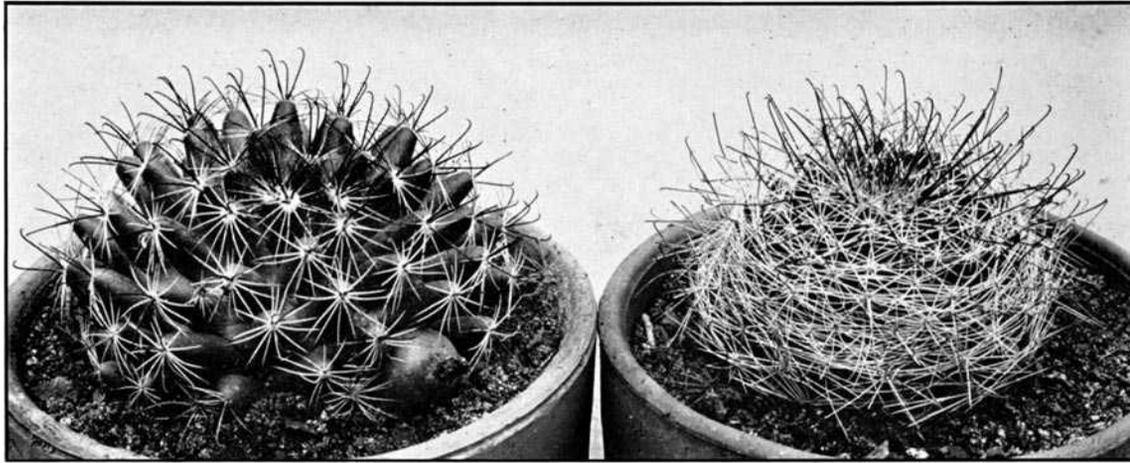


FIG. 148. LEFT: *Mammillaria Wrightii* x 0.5. FIG. 149. RIGHT: *Mammillaria Wilcoxii* x 0.5. Photos by Graham Heid of plants collected in New Mexico by Mrs Bullington of Deming.

112. *M. barbata* Engel.
 145. *M. Nelsonii* (Br. & R.) Berg.
 140. *M. Carretii* Rebut (*M. surculosa* Boed.)
 113. *M. mercadensis* Patoni
 108. *M. Solisii* (Br. & R.) Berg.
 M. Schumannii (*Bartschella* Br. & R.)
 M. phellosperma Engel. (*Phellosperma tetran-*
 cistra Br. & R.)

RECENT NEW SPECIES SINCE BR. & R.

Mammillaria balsasensis Boed., 1931, Guerrero. Simple, depressed-globose, soft in texture, glossy light green to dull deep red; rootstock carrot-like; tubercles conical; axils slightly woolly; areoles woolly when young; radial spines about 15, acicular, spreading white, often tipped with brown; central spines 4, stiffer, the lowest hooked, all dark brown.

M. Blossfeldiana Boed., 1931, Baja California. Usually simple, globose, dull green, less than 2 inches in diameter; axils of tubercles slightly woolly; tubercles of soft texture; areoles woolly when young; radial spines about 20, spreading, acicular, yellowish to grayish with darker tips; central spines 4, like the radials but stiffer and longer, hooked; flowers nearly 1 inch wide, carmine pink.

M. Bullardiana (Gates) Boed., 1934, Baja California. Cespitose, cylindrical; tubercles slender, conic, olive green; axils very slightly woolly; radial spines 20 to 30, white, acicular, spreading; central spine 1, brown, hooked; flower pale pink.

M. Gasseriana Boed., 1927, Coahuila. Cespitose, globose to oval, dull gray-green; tubercles closely set, oval; axils naked; radial spines 40 to 50, pectinate, in two series, radiating, white; central spines 1 or 2, white with dark brown tips, hooked; flowers creamy white.

M. guerreronis (Bravo) Knuth, 1932, Guerrero. Cespitose, cylindrical to 22 inches high, tubercles conic, clear green; axils woolly and bristly; areoles with white felt; radial spines 20 to 30, acicular, white; central spines 4, white with a rosy tint, one hooked.

M. Gulzowiana Werd., 1928, Durango. Resembling *M. bocasana* but larger, and not so prone to form clusters. It has but one central spine which is hooked; the flower is purple-red while that of *M. bocasana* is yellowish-white.

M. Hutchinsoniana Gates, 1934, Baja California. Cespitose, cylindrical; tubercles short conic, olive green; axils naked; radial spines 25 to 35, purple to black in youth, soon becoming white, spreading; central spines 3, one more elongated, hooked, all white with purple tips; flower creamy white.

M. insularis Gates, 1938, Smith Island, Gulf of Baja California. Rootstocks heavy, fleshy, divided and tapering; plants cespitose; branches flattened globose; tubercles conical; axils naked or slightly lanate; areoles circular, white woolly; radial spines 20 to 30, acicular, white, spreading; central spine 1, porrect, hooked, tips black; flowers light pink with white mid-stripe.

M. Moelleriana Boed., 1924, Durango. Simple, globose, glossy green; axils bare or slightly lanate; tubercles oval; areoles oval, at first abundantly white woolly; radial spines 35 to 40, acicular, white with yellow base, spreading; central spines 8 to 10, the lower 4 hooked, honey colored or dark red-brown; flowers pale pink to white.

M. Patoni (Bravo) Werd., Tres Marlas Islands. Cespitose, cylindrical, olive green; axils bare; tubercles cylindrical; areoles with yellow wool when young; radial spines 13 to 15 or more, gray with darker tips; central spines 4, dark reddish, one hooked; flowers purple.

M. Posseltiana Boed., 1932, Guanajuato. Simple, globose, apex depressed; tubercles conic, dark green, in 8/13 series; areoles woolly; radial spines 20, acicular, flatly spreading; central spines 4, white, hooked; axils lanate, flowers white with rose midrib.

M. pseudorekoi Boed., 1931, Pueblo, and *M. Rekoii* (Br. & R.) Boed., Oaxaca, "The Cactaceae," Vol. 4: pg, 141, are very similar as the names suggest.

M. Rettigiana Boed., 1930, Guanajuato. Simple, glo-

bose, glossy green; axils bare or slightly woolly; tubercles cylindrical; areoles white woolly when young; radial spines about 20, radiating, white or glossy yellow; central spines 3 or 4, stiffer, acicular, the lower one hooked; flowers clear pink.

M. unihamata Boed., 1937, Nuevo Leon. Simple or rarely branched, elongate-globose; tubercles conical; areoles orbicular, at first white woolly; radial spines straight, radiating, acicular, glassy, base yellow; central spine 1, porrect, stronger than the radials, hooked, red-brown; flowers unknown.

M. Weingartiana Boed., 1932, Nuevo Leon. Simple or cespitose, globose, dark green; tubercles conic, in 13/21 series; areoles round, at first white woolly; radial spines 20 to 25, white, spreading, straight; central spines at first 1, hooked, later 2 or 3 more short straight spines appear; flowers pale green with a reddish-brown midrib.

Series 5. **Polyacanthae.** To this section is assigned only *Mammillaria spinosissima* Lemaire, species number 76 in "The Cactaceae." It is a very variable species with many described varieties, of which the following are the best known:

- var. *auricoma* (*M. auricoma* Ehren.). Radial spines white; central spines white with golden yellow tips.
- var. *aurorea* (*M. aurorea* Dietr.). Radial spines pale yellow; central spines glossy yellow, darker at the tips.
- var. *brunnea* Salm-Dyck Spines reddish-brown.
- var. *castaneoidea* Lem. Central spines chestnut-brown.
- var. *flavida* Salm-Dyck. Spines all pale yellow.
- var. *Isabellina* (*M. Isabellina* Ehren.). All spines pale brownish-yellow.
- var. *pretiosa* (*M. pretiosa* Ehren.). All spines pure white.
- var. *rubens* Salm-Dyck (*M. sanguinea* Haage Jr.). New spines at the top blood-red becoming dark reddish-brown on the sides.

Series 6. **Heterochlorae.** To this section is assigned the following species described in "The Cactaceae":

- 54. *Mammillaria napina* Purp.
- 56. *M. kewensis* Salm-Dyck.
- 74. *M. phaeacantha* Lem.
- 85. *M. eriacantha* Link & Otto.
- 99. *M. Leona* Poselg, not *Neomammillaria Pottsii* which is actually *Coryphantha Pottsii*.
- 95. *M. gracilis* Pfeiff. (*Neomammillaria fragilis* Br. & R.).
- 92. *M. fertilis* Hild.
- 78. *M. Nunezii* (Br. & R.) Boed.
- 70. *M. yucatensis* (Br. & R.) Boed.
- 73. *M. cerralboa* (Br. & R.) Boed.
- 103. *M. Slevinii* (Br. & R.) Boed.
- 148. *M. umbrina* Ehren.
- 94. *M. discolor* Haw.
- 67. *M. Mundtii* Schum.
- 71. *M. Ruestii* Quehl.

75. *M. Graessneriana* Boed.

79. *M. amoena* Hopf.

72. *M. Pringlei* Brand.

77. *M. densispina* Coult.



FIG. 150. *Mammillaria densispina*. Photo from Germany.

59. *M. tetracantha* Salm-Dyck.

29. *M. polythele* Schum. (*M. multimamma* Knuth). *M. Lesaunieri* described on page 167 of Vol. IV, "The Cactaceae."

80. *M. rhodantha* Link & Otto, and its varieties as follows:

var. *chrysacantha* Schum. Stems broader and shorter; radial spines yellow and curved; central spines dark brown, the upper curved upward.

var. *crassispina* Schum. (*M. crassispina* Pfeiff.). Central spines thick, yellowish-brown or reddish-brown.

var. *Drogeana* Schum. All spines bulbous at base; radial spines yellowish; central spines pale brown, curved, the lowermost dark brown, longer, straight, directed backward; flowers pink.

var. *fulvispina* Schelle (*M. fulvispina* Haw.). Central spines clear brownish-yellow, radials yellowish.

var. *fuscata* Otto. (*M. fuscata* Otto). Radials white passing to yellowish, centrals yellow, tipped brown.

var. *Odieriana* Lem. (*M. Odieriana* Lem.). Spines of uniform thickness; central spines pale yellow, slightly curved.

var. *Pfeifferi* Schum. (*M. aureiceps* Lem.). Centrals lemon yellow, all alike, slightly curved.

- var. *pyramidalis* Schum. (*M. pyramidalis* Link & Otto). Centrals all similar, at first ruby red, passing to dark brown.
- var. *ruberrima* Schum. Centrals longer than in other varieties, dark red.
- var. *rubra* Schum. Central spines red.
- var. *stenocephala* Schum. (*M. stenocephala* Scheid.). Radials very short; centrals 4, reddish-brown, slightly curved.
- var. *sulphurea* Schum. (*M. sulphurea* Senke). Tubercles longer; centrals yellow; radials slightly curved, yellow.

RECENT NEW SPECIES SINCE BR. & R.

M. bogotensis Werd., Colombia. Usually simple, globose to clavate, green to gray green; axils densely woolly; tubercles conical; areoles oval, small, with white wool when young; radial spines 20 to 30, radiating, bristly, stiff, glassy white, short; central spines usually 6, sometimes only 1, acicular, radiating, yellowish with brown tips later gray or brownish; flowers and fruit unknown.

M. calacantha Tieg., 1933, Queretaro. Simple, globose, apex depressed; tubercles in 13/21 series; radial spines 25, short, deflexed; central spines 2 to 4, robust, ½ inch long; flowers carmine.

M. durispina Boed., 1928, Central Mexico. Mostly simple, globose to short clavate, dull dark green; axils lanate at first; tubercles closely set; areoles at first white woolly, radial spines 6 to 8, stiff, subulate, radiating, brownish or reddish-brown; central spines wanting; flowers deep carmine.

M. esperanzaensis Boed., 1932, Pueblo, has been known as *M. fuscata esperanza* Hort.

M. Fobeana Boed., 1933. Globose, apex depressed, somewhat woolly and with a few spines; tubercles in 13/21 series, short, conical; areoles small, naked; radial spines about 25, flatly spreading, yellowish, acicular, very short; central spines 6, subulate, short; flowers rose colored.

M. Hennisii Boed., 1932, Venezuela. Cylindrical, 10 inches high and nearly 4 inches in diameter; axils woolly; radial spines about 20, acicular, white; central spines 3 to 4, heavier, brown; flowers yellow or carmine-rose.

M. hidalgensis Purp., Hidalgo. Simple, cylindrical, dark green, up to 12 inches high, rounded at the woolly top; tubercles conical; axils and areoles at first white woolly, radial spines usually absent; central spines 4, spreading crosswise, sometimes only 2, nearly equal, grayish-white with brown tips; flowers carmine.

M. neocoronaria Knuth (*M. coronaria* Schum., 1898, not *M. coronaria* Haw., 1821), Hidalgo. Cespitose, green to grayish-green, globose to cylindrical; axils bare; tubercles conic; areoles elliptical, at first white woolly; radial spines 12 to 181 spreading, white; central spines 6, at first dark crimson, later gray; flowers crimson.

M. Wiesingeri Boed., 1933, Hidalgo. Simple, depressed globose; tubercles in 16/26 series; areoles round, at first woolly; radial spines about 20, white,

flatly spreading, short; central spines 4 to 6, base swollen; axils naked or with white setae; flowers carmine.

Section 2. GALACTOCHYLUS

Series 7. **Elegantes.** The following species of "The Cactaceae" are assigned here:

60. *Mammillaria elegans* D.C., Central Mexico (*M. dealbata* Dietr., and *M. potosina* Hort.).
- var. *aureispina*. Central spines white below, yellow to brownish above, upper spine ⅔ of an inch long, lower spine shorter.
- var. *dealbata* Dietr. Central spines pale yellow; stem more woolly at top.
- var. *nigrispina*. Central spines black, later passing to gray; upper spine 1/5 inch long, lower spine 3/5 of an inch long.
- var. *supertexta* (*M. supertexta* Mart.). Freely clustering, stems more slender, more rigid, up to 6 inches high; central spines 2 to 4, interlocked.

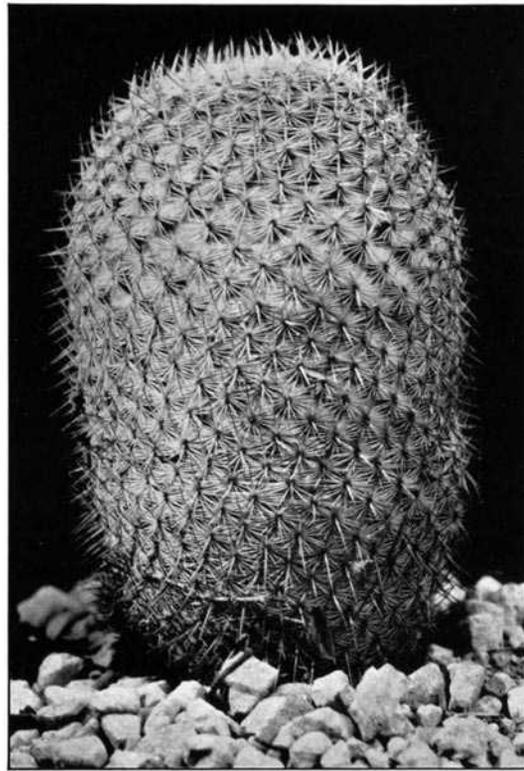


FIG. 151. *Mammillaria elegans* D.C. var. *Dealbata* x 1.
Photo from Germany.

63. *M. Haageana* Pfeiff.
66. *M. Donati* Berg.
68. *M. celsiana* Lem.
var. *longispina*
65. *M. collina* Purp.
64. *M. perbella* Hild.
33. *M. formosa* Scheid.

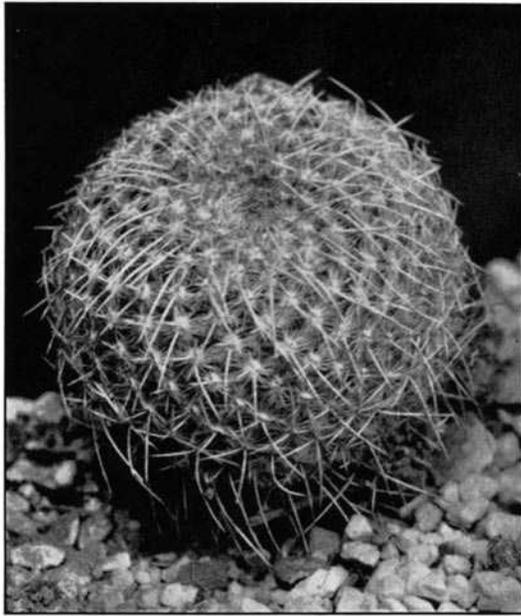


FIG. 152. *Mammillaria celsiana* Lem. x 0.5. Photo from Germany.

150. *M. xanthina* (Br. & R.) Boed.
M. conspicua "The Cactaceae," Vol. IV: pg. 108.
M. microthela Muehl. "The Cactaceae," Vol. IV: pg. 108.
M. leucentra Berg. "The Cactaceae," Vol. IV: p. 167.

RECENT NEW SPECIES SINCE BR. & R.

M. Brauneana Boed., 1933, Tamaulipas. Simple, globose, apex depressed, somewhat woolly and densely spiny; tubercles short, conical, in 21/34 series; areoles small, round, nude: radial spines 25 to 30, hair-like, short; central spines 2 to 4, subulate; axils with white bristles; flowers reddish-violet.

M. crucigera Mart. Cespitose, ovate to cylindrical; woolly at top; axils white woolly; tubercles closely set, conical, 4-sided at base; areoles with white wool; radial spines 24 or more, bristly, white, spreading, short; central spines 4, crosswise, short, waxy-yellow; flowers deep red.

M. Ochoteranae (Bravo) Werd., Oaxaca. Simple, depressed globose, grass green; tubercles closely set, in 13 rows; areoles slightly woolly; radial spines about 17, white, bristle-like, spreading, short; central spines 5, thicker, the lower one longest, straight, brown tipped, black when young; flowers pale pink.

M. Ritteriana Boed., 1925, Coahuila. Simple, globose, the top woolly; tubercles in 13/21 series, pyramidal; areoles orbicular, at first white woolly; radial spines 18 to 20, short, white; central spines 1 or 2, longer, porrect, white, yellow or red; axils at first naked, later white woolly; flowers white with a rose stripe.

M. Schmollii (Bravo) Werd., Oaxaca. Simple, depressed globose; axils naked; tubercles in 13 rows,

conical; areoles sparsely woolly when young; radial spines 23 to 25, radiating, glassy white, short; central spines 11 to 15, honey yellow, the middle one longest; flowers yellow.

Series 8. **Leucocephalae**. From "The Cactaceae" the following species are assigned here:

43. *M. geminispina* Haw.
 var. *nivea* Schum. Central spines longer, white, pale brown at tip; plant large, spines always straight, appearance of plant snowy.
 61. *M. pseudoperbella* Quehl.
 55. *M. lanata* Br. & R.
 42. *M. Parkinsonii* Ehren.

RECENT NEW SPECIES SINCE BR. & R.

M. albiarmata Boed., has been described.

M. albilanata Bckbg., 1939, Guerrero. Simple or cespitose, short cylindrical, to 6 inches high; tubercles short, conical; axils white woolly; areoles at first white woolly; radial spines 18 to 20, white radiating, interlacing, short; central spines 2, divergent, at first brownish or reddish, later becoming white, short; flowers dark carmine.

M. habniana Werd. & Bckbg., Queretaro. Simple or cespitose, depressed globose, entirely hidden by long white hairs; axils with long, hair-like bristles; tubercles conical; radial spines about 30, white, hair-like, long; central spines 2, straight, erect, white with reddish brown tips when young, later all white; flowers crimson.

M. Klissingiana Boed., Tamaulipas. Globose to cylindrical, glossy green; axils very woolly; tubercles small, closely set; radial spines 30 to 35, thin; central spines 2 to 4, spreading, tipped red when young; flowers pink.

M. saetigera Boed. & Tieg., 1932, Queretaro. Simple, depressed globose; tubercles in 13/21 series, pyra-

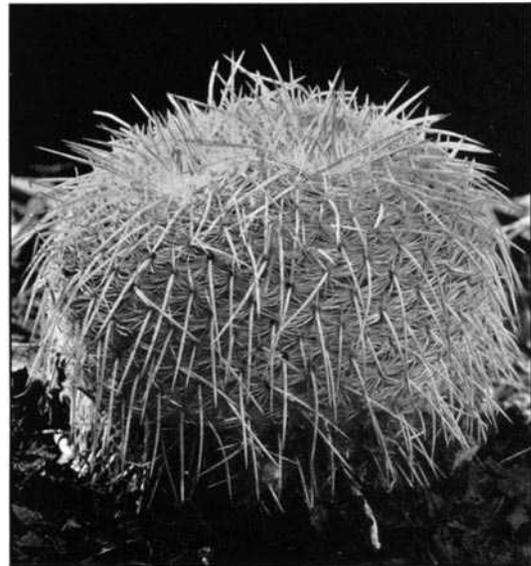


FIG. 153. *Mammillaria Parkinsonii* Ehrenb. x 0.75. Photo from Germany.

midal; areoles elliptical, at first woolly; radial spines 15 to 20, spreading, acicular, white; central spines 2, porrect, thicker and longer, white with red tips; axils woolly and hairy; flowers white with rose stripe.

Series 9. **Macrothelae**. From "The Cactaceae" the following species are assigned here:

1. *M. mammillaris* Karsten (*M. simplex* Haw., *M. Ekmannii* Werd., 1931, Navassa Island).
6. *M. Brandegeei* Engelm. (*M. Gabbii* (Coul.) Engelm.).
5. *M. arida* Rose.
4. *M. petrophila* Brand.
2. *M. nivosa* Link.
8. *M. Macdougallii* Rose.
9. *M. Heyderi* Muehl.
10. *M. hemisphaerica* Engelm.
11. *M. applanata* Engelm.
16. *M. melanocentra* Poselg.
21. *M. meiacantha* Engelm.
28. *M. crocidata* Lem.
3. *M. Gaumeri* Br. & R.
7. *M. gummifera* Engelm.
17. *M. Runyoni* Br. & R.
15. *M. Johnstonii* Br. & R.
24. *M. peninsularis* Br. & R.
20. *M. Ortegae* Br. & R.
18. *M. Sartori* Purp.
12. *M. phymatotothele* Berg.
13. *M. magnimamma* Haw. (*M. centricirra* Lem.).
No central spines; 4 radial spines.
var. *Bockii* Foerst. Grayish-green stem; acutely angled tubercles; 4 radial spines and 1 or 2 curved, dark, central spines.
var. *divergens* D.C. 4 radial spines, angular and recurved, yellow to gray.
var. *Krameri* Schum. Radial spines 4 or 5, radiating; one long central spine, curved downward; all spines yellow to white; flowers carmine,
var. *recurva* Schum. Tubercles only slightly angular; radial spines 4; central spine 1, curved downward, honey yellow, this and the upper radial thick and curved.
14. *M. macracantha* D.C.
32. *M. Zuccariniana* Mart.
19. *M. Seitziana* Mart.
27. *M. obscura* Hild.
30. *M. carnea* Zucc.
31. *M. Lloydii* Br. & R.
23. *M. gigantea* Hild.
26. *M. sempervivi* D.C. (*M. caput-medusae* Otto)
105. *M. uncinata* Zucc.
M. Trohartii Hild., "The Cactaceae," Vol. IV: pg. 170.
M. Zeyeriana Haage Jr., "The Cactaceae," Vol. IV: pg. 171.



FIG. 154. *Mammillaria collina* Purp. x 0.8. Photo by Wright Pierce (See page 185).

RECENT NEW SPECIES SINCE BR. & R.

M. Bachinannii Heese, Central Mexico. Simple, globose, dark green; tubercles pyramidal; areoles and axils woolly; central spines 4, crosswise, black; flowers pink.

M. Baxteriana Gates, 1934, Baja California. Simple or cespitose, flattened globose, 4 inches in diameter; tubercles conical, yellow green; axils white woolly; radial spines 8 to 10, acicular, spreading, white, occasionally brown tipped; central spines usually 1, acicular, white with brown tip; flower yellow.

M. glareosa Boed., 1932, Baja California, has been described.

M. Hamilton-Hoytae (Bravo) Werd., Queretaro. Usually simple, depressed globose, olive green, to 7 inches in diameter; axils naked; areoles almost bare; radial spines about 5, white with brown tips, short; central spines 3, stronger, the upper one less than 1 inch, the lower over 1 inch long and curved backward, at first reddish, becoming ash gray; flowers purplish.

M. Marshalliana Gates, 1934, Baja California. Simple or cespitose, depressed globose, blue green; axils slightly woolly; young areoles white woolly, circular; radial spines 8 to 13, spreading, white with dark tip, short; flower greenish-yellow.

M. melospina Werd., has been described.

M. Orcuttii Boed., 1930, Puebla. Simple, globose to clavate, dark blue-green; axils very woolly; tubercles short, conical; areoles at first densely white woolly; radial spines 4, rarely 5, strong, spreading outwards, straight, acicular, at first black or dark brown, the lowermost nearly an inch long, 6 to 8 short, white, hair-like spines about 2 mm. long to each areole; flowers pale carmine.

M. pacifica Gates, 1934, Baja California. Cespitose, sometimes branching by division of stems, depressed globose; tubercles closely set, somewhat pyramidal, dark green; axils lanate; areoles round, woolly in youth; radial spines 7 to 12, white with brown tips, spreading, acicular; central spine 1, ½ inch long, acicular, brown tipped; flower greenish-yellow.

M. roseoalba Boed., 1929, Tamaulipas. Simple, depressed globose, bluish-green; axils at first bare, later woolly; tubercles pyramidal; radial spines 4 to 6, short, subulate, dark pink at base, tipped white; flowers white.

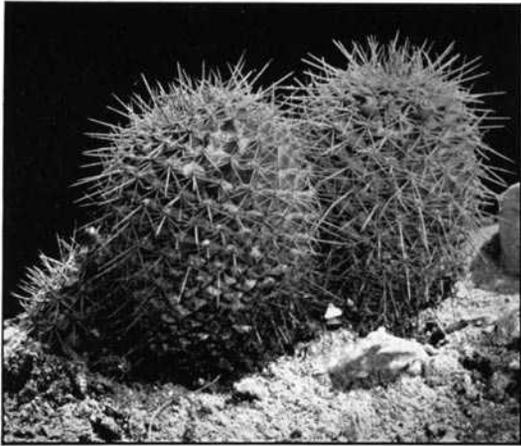


FIG. 155. *Mammillaria Sonorensis* Craig x 0.33. Photo by Graham Heid.

M. sonorensis Craig, 1940, Guirocoba, Sonora. Globose, apex depressed, simple or cespitose; tubercles globular-triangular, dull bluish-green; areoles oval, woolly in youth; axils woolly and bristly; radial spines 8 to 15; central spines 1 to 4, reddish-brown; flowers deep pink. The varieties *longispina*, *brevispina*, *Gentryi*, *Hiltonii* and *Maccartyi* were described in the Cact. & Succ. Journ. of Amer, Vol. XII: pg. 156.

M. Wagneriana Boed., 1932, Zacatecas. Simple, depressed globose; tubercles in 13/21 series, pyramidal; areoles at first white woolly; radial spines 9 or 10, subulate, white with brown tips, unequal; central spines 2 to 4, straight or twisted, 1 to 2 inches long, reddish, axils white woolly; flowers white with pale rose midrib.

M. Waltheri Boed., Coahuila. Simple, globose, dark green; axils bare; tubercles pyramidal; areoles small, round, at first white woolly; radial spines 12 to 14, acicular, spreading, grayish-white; central spine 1 sometimes 2, stiffer, amber yellow to black; flowers white.

M. Winteriae Boed., 1929, Nuevo Leon. Simple, depressed globose; axils at first white woolly; tubercles four angled; areoles woolly; radial spines 4, crosswise, about 1 inch long; acicular to subulate, grayish-red; central spine wanting; flowers yellowish.

M. Zahniana Boed., 1929, Central Mexico. Simple, globose, glossy dark green; axils woolly; tubercles four angled; areoles white woolly when young; radial spines 4, stiff, straight, white with dark tips; flowers sulphur yellow.

Series 10. **Polyedrae**. From "The Cactaceae" are referred the following species:

37. *M. Eichlamii* Quehl.

45. *M. woburnensis* Scheer. (*M. chapinensis* Eich. & Quehl.).

46. *M. Collinsii* Br. & R.

53. *M. Conzattii* Br. & R.

48. *M. tenampensis* Br. & R.

49. *M. polygona* Salm-Dyck.

47. *M. chionocephala* Purp.

52. *M. polyedra* Mart.

38. *M. Karwinskiana* Mart. (*M. Fischeri* Pfeiff.).

35. *M. mystax* Mart.

34. *M. compressa* D.C.

var. *fulvispina* Schum. Axils sparsely woolly, spines 5, yellowish-brown, tipped black when young, over an inch long.

var. *longiseta* Salm-Dyck. Robust, axils very woolly, spines up to 7, one central spine up to 1½ inch long, white, tipped yellowish-brown.

var. *triacantha* Salm-Dyck. Stem smaller, axils very woolly, spines 3, white, tipped yellowish-brown, the lower one less than 1 inch long.

var. *rubrispina* Hort. Spines red when young.

94. *M. Pettersonii* Hild. (*M. Heeseana* MacDowell)



FIG. 156. *Mammillaria compressa* D.C. var. *longiseta* Salm-Dyck x 0.33. Photo by Count F. M. Knuth, Denmark.

39. *M. Praelii* Muehl.

44. *M. pyrrocephala* Scheid.

var. *Malletiana* Cels. Plant more slender, tubercles closely packed; flowers yellow with a reddish midrib.

var. *fulvolanata* Hild. Axils and areoles with yellowish wool.

var. *Donkelaeri* Salm-Dyck. Plant larger, paler green; axils and areoles with white wool.

var. *confusa* (*Neomammillaria confusa* Br. & R.). Plant smaller, yellowish-green flower.

M. Knippellana Quehl. "The Cactaceae," Vol. IV: pg. 96.

RECENT NEW SPECIES SINCE BR. & R.

M. Esseriana Boed., Southern Mexico. Simple, clavate, gray green, dividing by splitting of the stem; axils with wool and bristles; tubercles four sided; areoles at first white woolly; radial spines up to 10, white, stiff, acicular, short; centrals 6, spreading, acicular or

subulate, amber yellow, tipped brown; flowers carmine.

M. Mendeliana (Bravo) Werd. Simple, globose, dark olive green; axils woolly and bristly; tubercles conic in 21 rows; areoles slightly woolly; radial spines hair-like, white; central spines 4, crosswise, sometimes only 1 or 2, less than an inch long, reddish to black; flowers pink.

Sub-tribe 7. **Epiphyllanæ**Genus 1. **Zygocactus** Schumann, 1890.

A genus of one species, *Zygocactus truncatus* (Pl. 221: Fig. 1), which is one of the most popular cacti. The stems are very flat and leaf-like, becoming triangular and woody in the old growth. The mature plants consist of several woody stems bearing branches composed of many short joints resembling leaves in chains. The flower arises from the end of these branches and has brilliantly colored petals in series, appearing as a long, double flower. The color ranges from white to scarlet. The habit of flowering in December has given to this plant its common name of Christmas Cactus. Another common name, Crab Cactus, refers to the shape of the flattened branches.

Habitat: Mountains of Brazil.

Culture: The plants in nature are epiphytic on trees, therefore a soil of three-fourths leaf-mold and one-fourth sand is advisable. During resting period, from early spring until late summer, water very sparingly and do not worry if the plants appear to shrink and wilt or even lose some terminal joints. As soon as the stems show signs of renewed life, increase the water allowance and apply a good fertilizer; well-rotted cow manure or bone meal are good. Partial shade is preferred by the plants and temperatures must be kept above freezing. The addition of a small portion of peat to the above soil mixture will help to retain moisture.

Desirability: Since its introduction into cultivation in 1818, this species has been a popular favorite as a household plant and is perhaps the most extensively cultivated species of cacti.

Desirable species: *Zygocactus truncatus*

Genus 2. **Epiphyllanthus** Berger, 1905.

In plant body resembling small *Opuntias*, but with flowers similar to those of *Zygocactus* (Pl. 23: Fig. 2).

This interesting group of 3 species is rare, al-

(Haw.) Schum., has been extensively hybridized and many choice color combinations are available. Nicholson's "Garden Dictionary" describes some of the best as follows:

"*Bicolor*, white, edged with rose; *coccineum*, rich deep scarlet; *elegans*, bright orange-red, center rich purple; *magnificum*, flowers large, white, tips bright rose-colored; *roseum*, bright rose; *rucheranum*, deep reddish-purple; *salmon-eum*, reddish salmon; *spectabile*, white with delicate purple margin; *violaceum superbum*, pure white, rich deep purple edge."



FIG. 157. Flower of *Zygocactus truncatus*. Photo by Dr. Stephen Darling.

though *Epiphyllanthus obtusangulus* (Schum.) Berg., is now available and this usually as a grafted plant. Only 3 species are known, *E. microsphaericus* is an *Arthrocerus*.

Genus 3. *Schlumbergera* Lemaire, 1858.

In body shape this genus greatly resembles *Zygocactus*, but the scarlet to purplish flowers open wheel-shaped (Pl. 23: Fig. 3). The habit of early spring flowering accounts for the com-

mon name, "Easter Cactus." Two species are known, *Schlumbergera Gaertneri* (Schum.) Br. & R., and *S. Russelliana* (Hook.) Lem., and the culture is the same as for *Zygocactus*.

Genus 4. *Epiphyllum* (Hermann) Haworth, 1812.

This is a genus of 20 species usually found epiphytic on trees in nature. The stems resemble greatly elongated leaves, the usually large, white

Desirable species: Epiphyllum latifrons (Link) Zucc., *E. phyllanthus* Haw., *E. anguliger* (Lem.) Br. & R., *E. crenatum* (Lem.) Br. & R., *E. guatemalense* Br. & R., and *E. Hookeri* Haw., are the favorites.

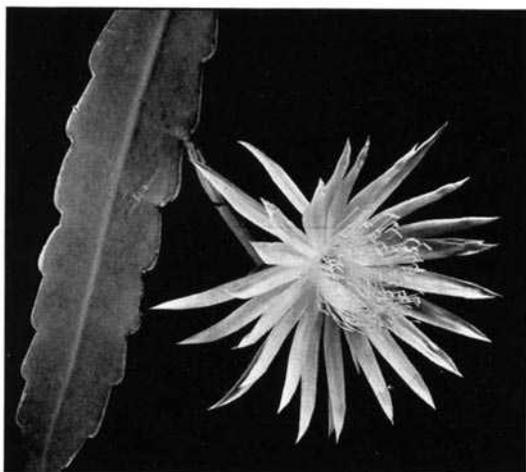


FIG. 158. *Epiphyllum strictum* (Lem.) Br. & R. x 0.33.
Photo by Wright Pierce.

flowers are night-blooming, but sometimes open by day. They arise from areoles on the margins of the leaf-like stems (Pl. 23: Fig. 4), and from this habit the generic name, *Epiphyllum*, was coined from the Greek words for "upon" and "leaf."

Habitat: Mexico, West Indies, Central America, and South America.

Culture: Partial shade, soil composed of three-fourths leaf-mold and one-fourth sand; water freely in growing season but allow a resting period after the plants have flowered, and withhold water or at least reduce water allowance during that period.

Desirability: Several species are very popular although none so popular as the hybrids which we list under "Orchid Cactus."

Uses: As ornamentals. The fruits of many species are sweet and edible.

ORCHID CACTI

Numerous hybrids between *Epiphyllums* and the red-flowered, day blooming genera are sometimes called *Phyllocactus*, but perhaps best known as the "Orchid Cacti." The flowers rival in delicacy of texture and sheen the largest of the *Cattleyas* of the Orchid family, and are much more easily grown.

Culture: A very rich soil is best. One-half leaf-mold, one-fourth sand and one-fourth loam. Never use lime or gypsum. Reduce water allowance in the resting period after blooming, and allow plants to partly shrivel up if so inclined. Never allow plants to be completely dry and do not withhold water from seedlings. A complete rest period means more flowers. As soon as the stems begin to show signs of filling out in early spring, increase the water allowance and add well-rotted cow manure or bone meal on top of pot, working into soil gradually.

Desirable species: The following "Orchid Cacti" have been thoroughly tested and are among the most desirable of the many species and afford a wide range of colors and exceptional hardiness:

AGATHA (Syn.: Peach Blow). Flower 6 to 7 inches across, clear, strong pink with a striking crimson center.

CONWAYS GIANT. Vigorous plant with broad stems that are crimson or purplish in new growth, flowers very large with broad petals of firm texture, outer petals deep crimson, inner petals red, shaded with purple and violet.

DANTE. Plant vigorous, stems usually triangular, flowers 8 inches broad, symmetrical, wide opening; petals numerous, standing well apart, light orange red, the inner petals overcast with red violet, the color being strongest at the margins.



FIG. 159. Epiphyllum flowers. Courtesy "Gardeners Chronicle" Nov., 1939.

EDEN. Stems strong, frequently triangular; flowers large, opening wide; outermost petals bronze, next series yellow, innermost petals white; the flower is fragrant.

GLORIA. Very free flowering, flowers 8 inches broad or more, opening wide; the color of the flower is pure copper but it may vary slightly with the season and has been variously described as light red, apricot or salmon.

HERMOSISSIMUS. Tall growing plant with notched stems; flowers up to 9 inches broad; the petals stand apart and display a combination of vivid scarlet, crimson with violet edges and a narrow central stripe of orange.

LATONA. Large, free flowering; flowers give the general effect of deep pink but the outer petals are flame color with a dull orange center, and the inner petals shade from burnt orange at the center to red violet at the edges. Somewhat variable in color.

MAUVETTE. Vigorous, fast growing, the stems glossy green; the flowers are 8 inches in diameter of solid mauve or light magenta.

M. REVIERE. A very fine flower with flashy color-

ing containing a lot of orange; flowers 7 inches in diameter, the outer petals orange red, the inner petals broad with an orange central stripe and broad violet carmine border.

PADRE (Syn.: Alpha, Emaline). Stiff, thick stems of vigorous green; flowers medium to large, pale pink to darker, with waxy petals and elegant form.

PEACOCKII. Stems triangular with a few stiff bristles in the notches; flowers usually 8 inches broad, opening nearly flat; outer petals orange to scarlet; innermost petals scarlet, intermediate ones scarlet with carmine margins.

ROSETTA (Syn.: Rosette, John Morley). Plant compact; flowers $\frac{1}{4}$ inches across at base, shaped like a rosebud; color very deep rose or pink magenta.

SCARLET GIANT. Flowers 9 inches broad, color orange scarlet, carmine in center.

SCHEHERAZADE (Syn.: Magenta). Large flowers of pure pink, fading to magenta pink.

VIVE ROUGE. Flowers medium to large, opening wide, brilliant scarlet tinged with violet in throat. Very free bloomer.

Genus 5. **Disocactus** Lindley, 1845.

A genus of Epiphyllum-like plants (Pl. 24: Fig. 5), with day-blooming, small flowers which are borne near the tips of the branches. The tube is short and the petals are few; the small, cylin-

drical ovary bears a few, minute scales. Two species are known, *D. biformis* Lindley, and *D. Eichlamii* (Weing.) Br. & R., but they are not known to be in cultivation in this country.

Genus 6. **Chiapasia** Britton and Rose, 1923.

A genus of Epiphyllum-like plants whose one species (Pl. 24: Fig. 6), *C. Nelsonii* Br. & R., has been recently introduced here. It differs from *Epiphyllum* in its lily-like, rose-pink flowers which have but few petals. It needs the same care as for *Epiphyllum*.



FIG. 160. Flower of *Chiapasia Nelsonii* (Vaupel) Br. & R.
Photo by Mrs. Monmonier in her Ventura Epiphyllum Gardens.

Genus 7. **Eccremocactus** Britton and Rose, 1923.

A genus from Costa Rica whose one species (Pl. 24: Fig. 7), *E. Bradei* Br. & R., has flat but thick stems resembling a very robust *Epiphyllum*. The flowers, however, are less than 3 inches

long, pinkish, and fleshy. The angled ovary bears short hairs at the axil of thick, egg-shaped, purple scales. The same culture as for *Epiphyllum*.

Genus 8. **Nopalxochia** Britton and Rose, 1923.



FIG. 161. *Nopalxochia phyllanthoides* is one of the finest cacti and produces abundant flowers.

A genus of flat-jointed, epiphytic cacti. The joints leaf-like (Pl. 24: Fig. 8), and bearing from their margins the rather large, short funnel-shaped, rose to red flowers. They come from either Mexico or Columbia, but the origin is rather uncertain. First introduced in 1651, it is one of the oldest known cacti but has not been collected in recent years.

The one species, *Nopalxochia phyllanthoides* has been hybridized with other species in the sub-tribe and now it is difficult to tell just which is the true species. Under its common name, Empress of Germany, or Deutsche Kaiserin, it or its hybrids are very popular for the abundance of pink flowers.

Culture: as for *Epiphyllum*.



FIG. 162. *Nopalxochia phyllanthoides* (D.C.) Br. & R., used as a cut-flower arrangement.

Genus 9. *Wittia* Schumann, 1903.

A genus of Epiphyllum-like plants which bear very small, cigarette-shaped, purplish flowers (Pl. 24: Fig. 9), about 1 inch long. The

two species, *W. amazonica* Schumann and *W. Panamensis*, are missing from our American collections.

Sub-tribe 8. *Rhipsalidanae*

As all of the plants in this sub-tribe are alike in the small, very insignificant flowers, and as all are epiphytic on trees in tropical regions, it might be well to consider them as a unit, (see Plate 25)

Borg in his treatment of this sub-tribe follows Britton and Rose exactly, except in the genus *Lepismium* where he recognizes the four varieties of *L. cruciforme* as good species under the names of *L. commune* Pfeiff., *L. myosurus* Pfeiff., *L. cavernosum* Lindb., and *L. anceps* Weber, and in the genus *Rhipsalis* where he lists 58 species—the same number listed by Britton and Rose, but listed under names relegated to synonymy by them.

Backeberg also agrees in the main with the Rosean arrangement of genera but he places the

genus *Pfeiffera* in Sub-tribe I CEREANAE and transfers to the genus *Lepismium* a number of species of *Rhipsalis*. Backeberg also frequently restores names from the synonymy to specific rank but all names listed by him or by Borg will be found in "The Cactaceae" index under *Rhipsalis* except two new species listed by Backeberg as follows:

Lepismium cereoides Bckbg. & Voll., 1935, Brazil.

Lepismium Vollii Bckbg., 1935, Brazil.

Britton and Rose rejected the generic name *Hariota* proposed by De Candolle in 1834 because of the prior use of that name by Adanson in 1763 and substituted *Hatiora*, an anagram of the older name. *Hariota* is, however, the accepted name of this genus under International Rules and we follow the general usage.

We will consider only one genus, *Rhipsalis*, because it is represented in almost every collection and should be even more popular because

of the hardiness and easy culture of some of the species. The culture is exactly alike for all of the genera.

Genus 8. *Rhipsalis* Gaertner, 1788.

The generic name is from the Greek "wicker-work," referring to the slender, pliable stems of the majority of the species. The plants inhabit trees in tropical forests and hang in long festoons attached by air roots to the branches, but taking no nourishment from the host tree. Sometimes these stems fall into moss or humus at the base of the trees and there root and become terrestrial plants.

The stems are sometimes flattened and leaf-like, sometimes round and then pencil-shaped (Pl. 25: Fig. 8), or occasionally they resemble the links of a chain due to short, flattened stems attached in zig-zag formation. The small flowers are white, cream or pinkish and are followed by small, juicy berries which are very attractive with their white, red, or purple colors. The plants do not suggest their cactus relationship and few persons would associate them with their spiny relatives. It is difficult to make people believe that these species are really cacti, yet the flowers, fruit, leafless stems and spine cushions or areoles, all meet the qualifications for a true cactus.

Habitat: Forests of Mexico, the West Indies, Central America, South America, South Africa, and the Island of Madagascar.

Culture: The trailing habit suggests the advisability of hanging-basket culture, but either in baskets or pots, a soil of leaf-mold with some German peat added, produces best results, being nearest to natural conditions. Water freely at all times as the roots must be kept damp for best results although a drying out would not prove fatal. Partial shade is necessary for most species and temperatures above 60 degrees are recommended. For glasshouse culture this group of plants is excellent, suggesting, to the casual observer, ferns rather than cacti.

Desirable species: A collection selected from this group for diversity of form and availability of plants should include *Acanthorhipsalis crenata* Britton, flat-stemmed with a few small

spines at each crenation of the stem; *Lepismium cruciforme* (Vellozo) Miguel, purplish, three-angled stems with tufts of long, white hairs on margins; *Hariota salicornioides* (Haw.) Br. & R., club-shaped branches; *Rhipsalis prismatica* Rümpler, the so-called Coral Plant; *R. pentaptera* Pfeiff., a ribbed-stem species, usually dark green; *R. paradoxa* Salm-Dyck, the Chain Rhipsalis; *R. pachyptera* Pfeiff., a flat-stemmed plant, usually highly colored; and *R. rhombia* (Salm-Dyck) Pfeiff., or *R. crispata* (Haw.) Pfeiff., representing the flattened, oval-shaped stems.



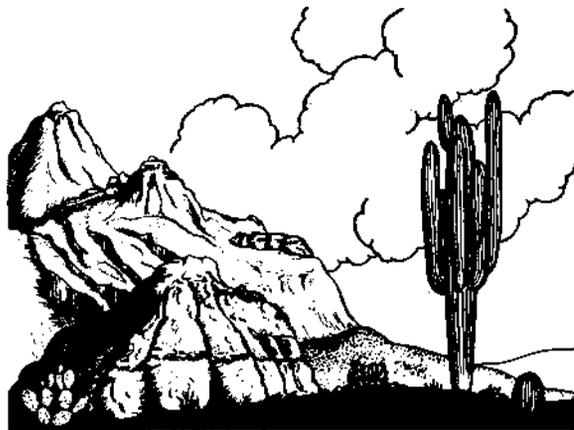
FIG. 163. *Rhipsalis* collection in a hanging pot in the R. W. pointdexter Nursery. In the summer the glass must be white-washed in order to give these plants partial shade.

Photo by Scott Haselton.

APPENDIX I.

Botanical Plates

PLATES A., B. Forms Pages 196, 197
PLATE C. Stem sections Page 199
PLATE D. Spine forms. . . . Page 200
PLATE E. Flower forms Page 201
PLATE F. Flower parts. . . . Page 202



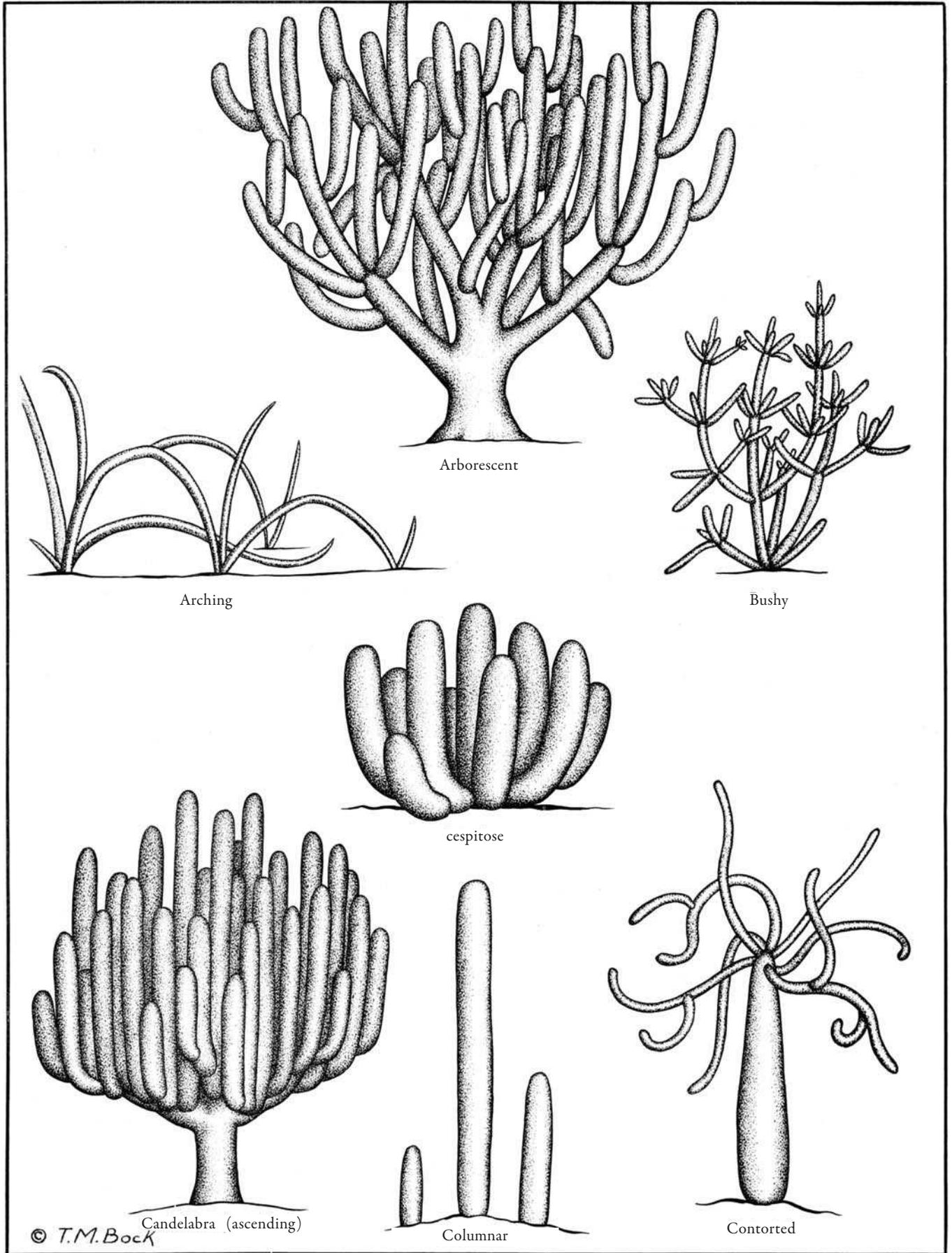
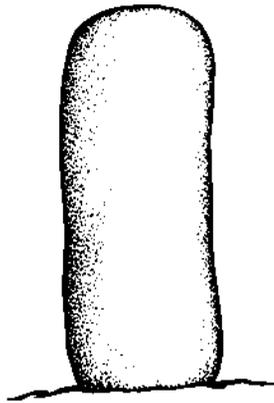


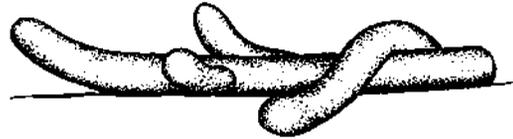
PLATE A.



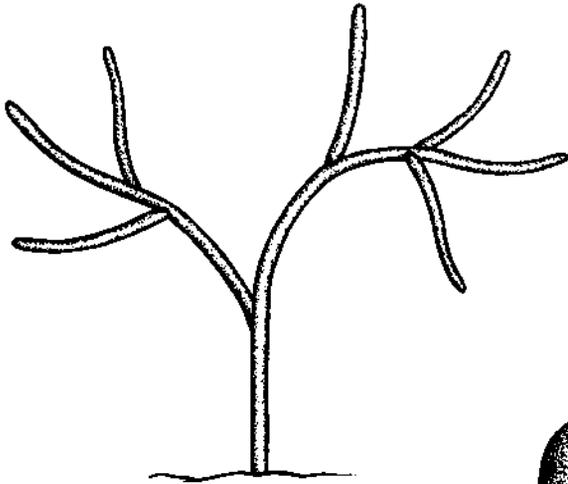
Creeping



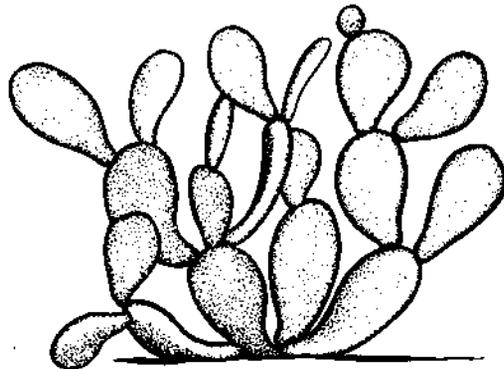
Cylindric



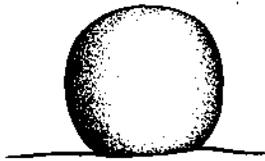
Decumbent (prostrate)



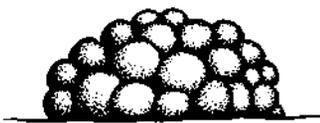
Diffuse



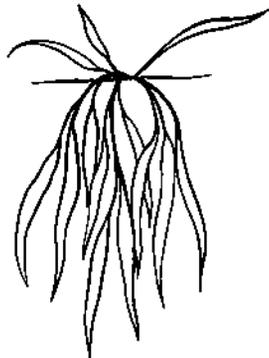
Flat jointed



Globose



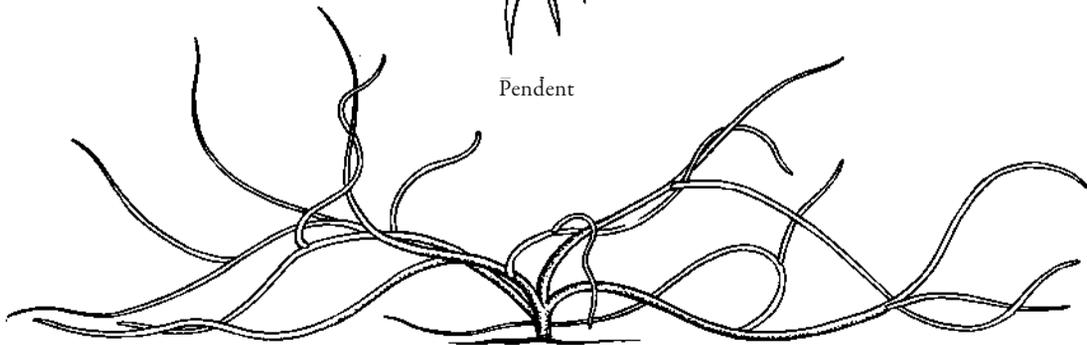
Globose caespitose



Pendent



Strict branches



Vine-like

© T.M. Bock

STEM SECTIONS

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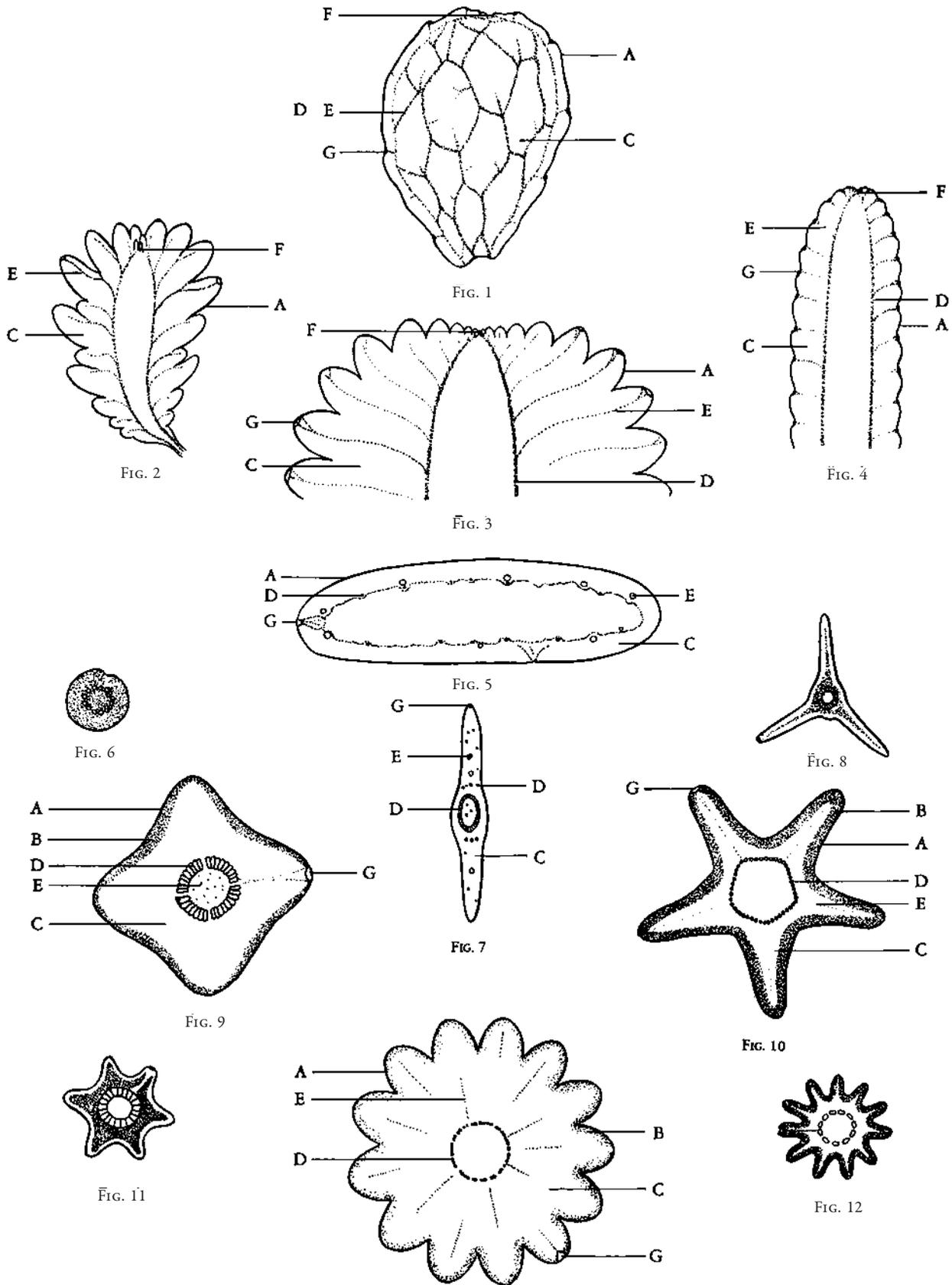
- A. Cutin
- B. Chlorophyll
- C. Cambium layer
- D. Fibrovascular bundles
- E. Vascular supply
- F. Meristem
- G. Areole

TRANSVERSE SECTIONS

1. *Opuntia*
2. *Mammillaria*
3. *Pediocactus*
4. *Nyctocereus*

CROSS SECTIONS

5. *Opuntia*
6. *Pereskia*
7. *Epiphyllum*
8. *Hylocereus*
9. *Eriocereus*
10. *Cereus*
11. *Selenicereus*
12. *Nyctocereus*
13. *Trichocereus*



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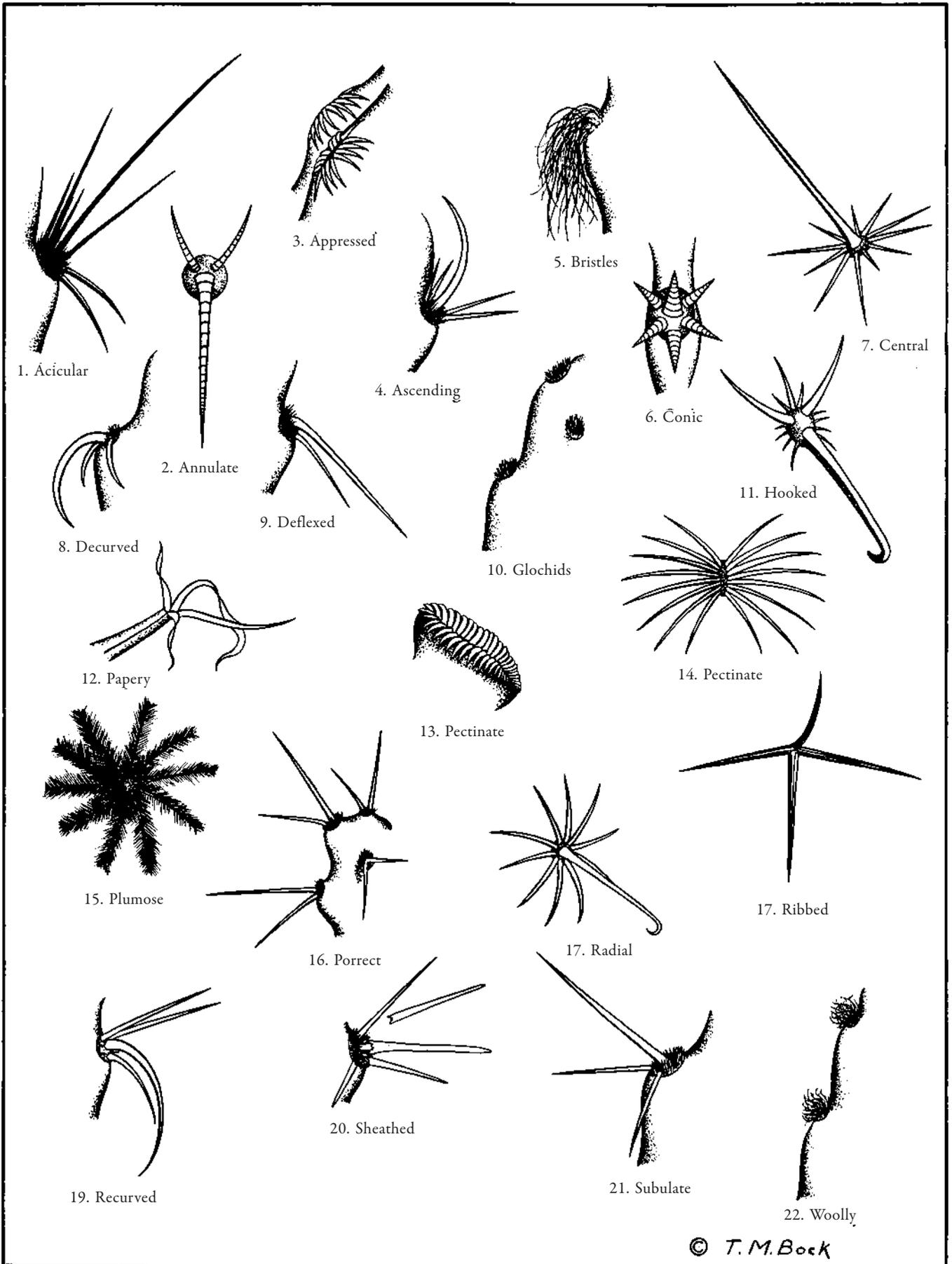
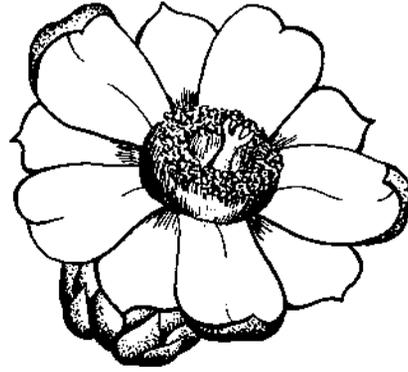


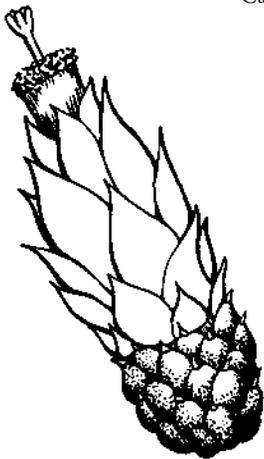
PLATE D.



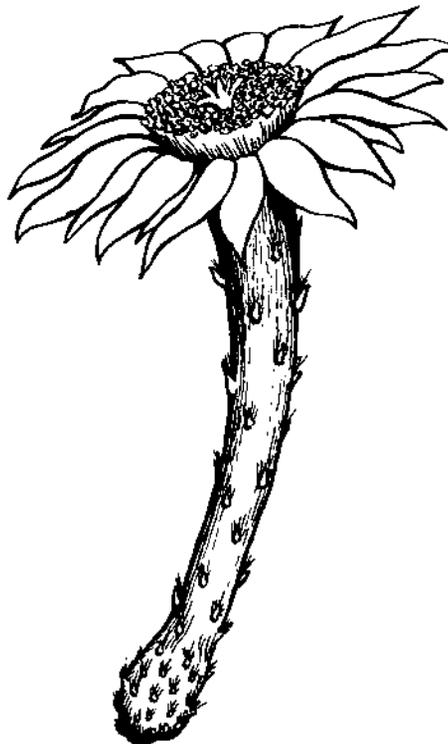
Campanulate



Rotate



Tubular



Salverform



Funnelform



Pyriform



Cylindric

© T. M. Back

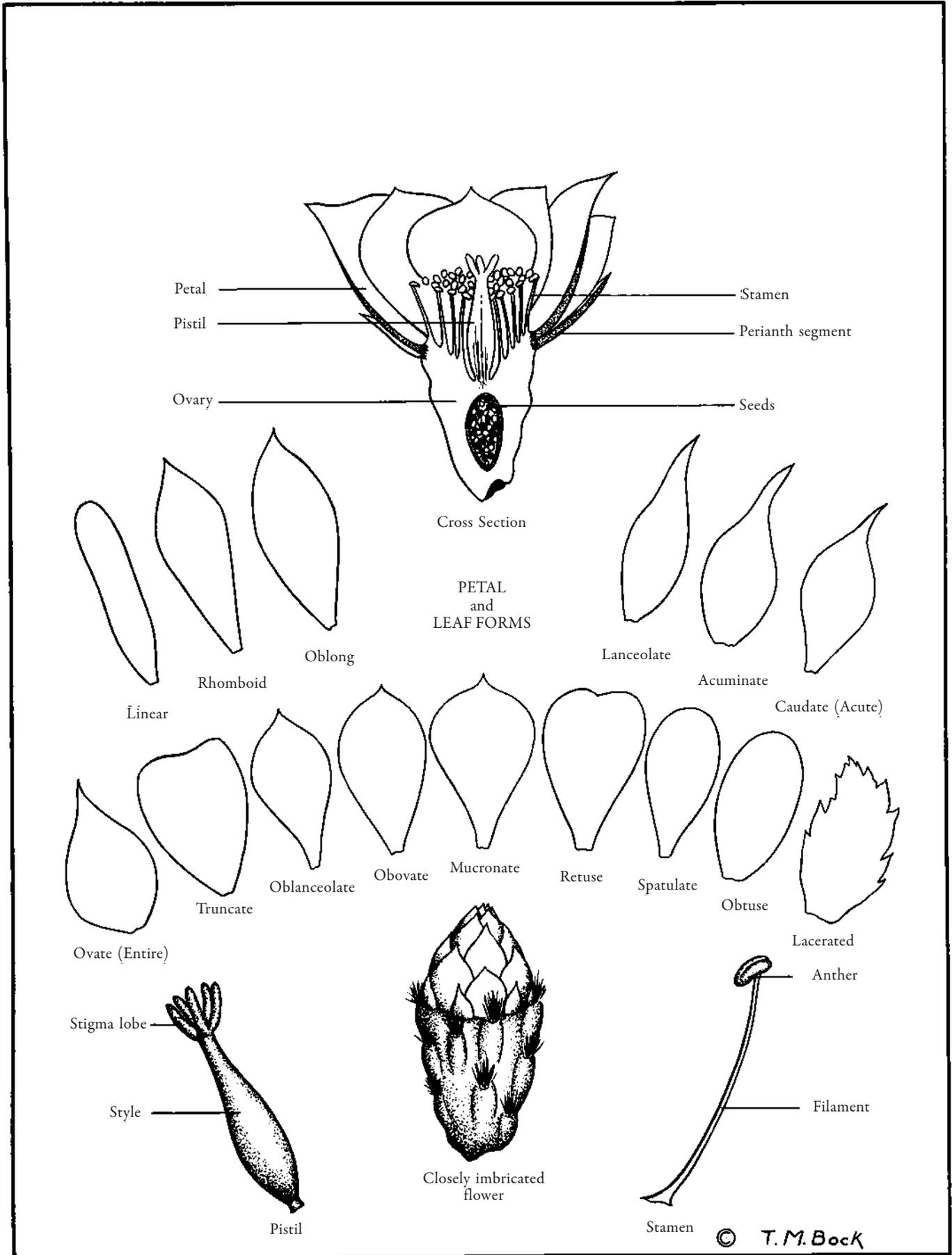


PLATE F.

Cultural Notes

Relatively few of the cacti are strictly desert plants, but even these few arid district dwellers grow in rich but very well drained soil. Contrary to general belief, the desert soils are rich in humus and as new districts are brought under cultivation by the extension of irrigation systems, it will be noted that crops can be grown for a number of years without the addition of plant foods.

In cultivation, the desert types are the most difficult of all cacti to re-establish and grow, and we recommend that they be attempted only in the drier climates such as Colorado and New Mexico. For the more humid sections or for glasshouse use, we suggest seedlings grown by dealers who have successfully acclimated the desert plants by growing the seed under glass. Such seedlings are more perfect than collected plants and can be successfully grown where collected plants do not thrive.

All species of cacti, except strictly desert types, do better when supplied with liberal applications of water in their growing season. The term "growing season" as used herein indicates that period of salubrious weather during which the plants show active growth. This season varies in different geographical districts.

Plants kept in heated or partly-heated glass houses will commence growth earlier than plants which are set out in the ground, kept in unheated glasshouses, or stored in cellars and attics. Therefore, determination of the condition of dormancy or activity of any plant must be judged by observation.

Species that bear leaves indicate spring growth by sending forth leaf buds. Leafless plants indicate renewed activity by the presence of bright, new spine clusters at the growing center of the plant.

PESTS AND THEIR CONTROL

Cacti are relatively free from pests, but there are a few insects, scales and diseases that occasionally attack them. The most noticeable of these is the spine mealy bug whose presence is indicated by small white masses on the spines of the plant. A white scale which attacks the cutin of cacti can be detected by the presence of small white spots.

The best treatment for spine mealy bugs or scale is to spray the plant with an oil emulsion, such as "Volck." For plants with hairy spines, or for tender plants, such a treatment is too severe and may result in unsightly burns or discoloration of the hair-like spines.

A less severe spray is a Rotenon-Pyrethrin combination, such as is found in "Extrax." This is efficient if applied three or four times, at three day intervals. These sprays may also be used for red spider, thrip and cochineal insects.

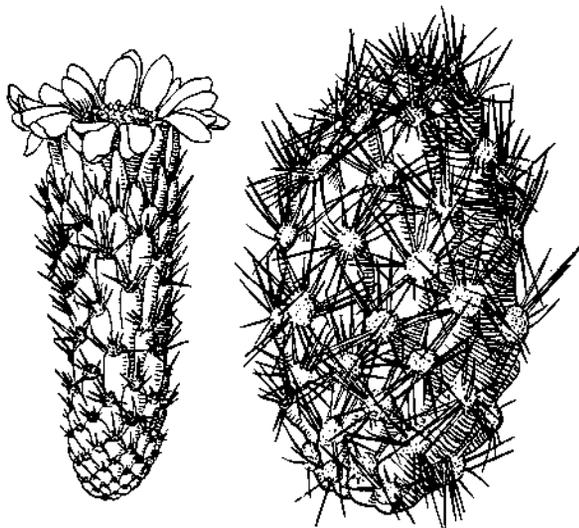
Perhaps the worst menace to cactaceous plants is the root mealy bug which is particularly prevalent in collections of potted plants. Applications of dichloroethylether in solution in water is the only sure remedy for root mealy bugs. It can most conveniently be obtained in the numerous commercial sprays offered for lawn moth control, such as "Golden Lawn Moth Spray."

Tiny white or yellowish blisters or soft black spots frequently appear on plants of *Acanthocereus* and *Trichocereus* especially, but may occasionally be found on any cactaceous plants. These symptoms indicate a fungus attack and the indicated remedy is a spray with a copper base, such as "Greenol."

It is safe to say that a garden free from ants is a garden free from scale and mealy bugs, so the control of ants is of prime importance. In California we have found "Antrol" the most satisfactory solution of the ant menace.

Errata

While this book was on the press, a plant of *Lemaireocereus Godingianus* came into flower in the garden of the late Dr. A. D. Houghton at San Fernando, California. This is the first time that any of the South American species of *Lemaireocereus* have flowered here, to my knowledge. At first sight the flower appeared to be typical of the genus *Brachycereus* because of the long limb of the flower and the ovary which was covered with areoles bearing clusters of non-pungent, bristly spines. Although the limb



Flower and fruit of *Lemaireocereus laetus* x 0.6.
From Br. & R.

was nearly three inches long, the tube proper was only about $\frac{3}{4}$ of an inch long. The resemblance to *Brachycereus* was only external for the filaments were long and placed in several series in the limb, while in *Brachycereus* the filaments are only about $\frac{1}{25}$ of an inch long. The flower in every respect resembled the line drawing of the flower of *Lemaireocereus laetus* illustrated in Britton and Rose and reproduced here. After

seeing this flower, I reaffirm my opinion that these two species and *L. Cartwrightianus* should be retained in the genus *Lemaireocereus* rather than its being placed in a separate genus.

Add to *Notocactus ottonis* on page 158 the following varieties:

Var. *brasiliensis* Haage Jr. The yellowish-brown radial spines are erect; the straight, brown central spine shorter than in the species; the petals of the flower are heart-shaped and the stigma lobes 11.

Var. *Linkii* (Lehm.). The short, bristly radial spines are flattened to the plant body; the curved central spines are longer than in the species; the flowers are smaller.

Var. *paraguayensis* Haage Jr. The ribs in this variety are less rounded, almost acute and the spines are red.

Var. *tenuispinus* Schum. The pale radial spines are bristle-like, and the inch-long centrals are reddish-brown.

Var. *tortuosus* Schum. The deeply notched ribs are spiralled; the brown radial spines are longer than in the species and spread irregularly; the flowers are smaller than in the species.

Var. *uruguayensis* Arech. Plant very robust with 11 ribs which are broad and rounded bearing widely spaced areoles.

The genus *Porfiria* has been misspelled twice on page 48.

To the genus *Mammillaria*, Series 3. *Stylothele*, page 1981, add the following new species since Br. & R.

M. Inaiae Craig, Cact. and Succ. Journ. of Amer., Vol. 10: pg. 111, Sonora, Mexico. Plant simple or clustered, light green, cylindrical; tubercles pyramidal, areoles oval, woolly when young; axils bearing a little white wool in youth and an occasional bristle; radial spines 17 to 24, acicular, white, short; central spines 2 or 3, subulate, slightly bent at tip, short; flowers yellowish-white, the inner petals white with a pinkish base and midrib.

APPENDIX IV.

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Abbreviations of Botanists

Arech.	J. Arechavaleta	Lem.	Charles Lemaire
Bckbg.	Curt Backeberg	Leon	Brother Leon
Berger	Alwin Berger	Link	Heinrich F. Link
Big.	Dr. j. Bigelow	Linn.	Carolus Linnaeus
Boed.	Fr. Bödeker	L. & O.	Link and Otto
Bonpl.	Aimé Bonpland	Mart.	Karl F. P. von Martius
Brand.	K. Brandegee	R. Mey.	R. Meyer
Bravo.	Miss Helia Bravo H.	Miller	Philip Miller
Brit.	Dr. N. L. Britton	Mon.	M. Monville
Br. & R.	Dr. N. L. Britton & Dr. J. N. Rose	Muehl.	Dr. F. Muehlenpfordt
Castel.	Alberto Castellanos	Otto	Friedrich Otto
Coult.	Dr. John M. Coulter	Pfeif.	Dr. L. Pfeiffer
D.C.	A. P. De Candolle	Phil.	Dr. Rudolph A. Philippi
Dietr.	Dr. A. Dietrich	Poselg.	Dr. H. Poselger
Ehren.	Dr. C. A. Ehrenberg	Purp.	Dr. C. A. Purpus
Eich.	Federico Eichlam	Quehl	L. Quehl
Engel.	Dr. George Engelmann	Rebut	P. Rebut
Gal.	H. Galeotti	Riccob.	V. Riccobono
Greis.	H. R. A. Greisbach	Rose	Dr. J. N. Rose
Gürke	M. Gürke	Rümpl.	Theodor Rümpler
Haage Jr.	F. A. Haage Jr.	Salis.	Richard A. Salisbury
Haw.	Adrian Hardy Haworth	S.D.	Prince von Salm-Dyck
H.B.K.	F. A. von Humboldt, A. Bonpland and Karl S. Knuth	Scheid.	Dr. Michael J. Scheidweiler
Hildm.	H. Hildmann	Schum.	Dr. Karl M. Schumann
Hopf.	Carl Hopffer	Small	Dr. John K. Small
Jac.	Baron Nicholas J. Jacquin	Speg.	Carlos Spegazzini
Kar.	Wilhelm Karwinsky von Karwin	Voll	O. Voll
Kars.	Herman G. K. W. Karston	Vaupel	Friedrich Vaupel
Knuth	Count F. M. Knuth	Web.	Friedrich Weber
Kunth	Dr. Karl S. Kunth	Wein.	W. Weingart
Lab.	J. Labouret	Werd.	Dr. Eric von Werdermann
Lehm.	Dr. Johann G. C. Lehmann	Zucc.	Joseph G. Zuccarini

Index

This index contains the names of all the genera and species of the family Cactaceae, known to us. Genera and species that are not accepted are in italics while the accepted genera and species are in Roman type. Subdivisions of the family lower than tribes, sub-tribes, sections, and sub-genera, are in Roman capitals. Species listed without page numbers are valid species of the genus under which they are listed, and which have been described in «The Cactaceae» of Drs. Britton and Rose.

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